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AN ANALYSIS OF THE EFFECT OF GRADUATE EDUCATION ON THE JOB PERFORMANCE OF FEDERAL (DOD) CIVILIAN EMPLOYEES

by
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The main purpose of this study is to examine the relationship between graduate education and the job performance of DoD civilian employees. The thesis focuses on selected job performance measures for all civilian DoD personnel employed between 1986 and 1999, except for those in the National Imagery and Mapping Agency and direct and indirect hire civilian employees outside the 50 states and the District of Columbia. The Defense Manpower Data Center (DMDC) provided the personnel data. Performance measures that are analyzed include promotion, promotion speed, performance ratings, earnings and retention. Three different techniques are used to estimate performance models. First, ordinary least squares is used to estimate the salary and performance rating models. Second, binary logit regression is used to estimate promotion, retention, and performance rating models. Third, survival analysis using Cox Regression estimates the speed of promotion and the time to separation. The results indicate that employees with a Master's or Doctorate earned more in average salary but experienced lower salary growth than employees with a Bachelor's degree. Also advanced degree holders are promoted more slowly since they enter at a higher GS grade. Higher educated employees were also more likely to leave federal service, but were more likely to receive top ratings and achieve a supervisor position.

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I. INTRODUCTION

A. PURPOSE OF THE THESIS

The main purpose of this study is to examine the relationship between graduate education and the job performance of Department of Defense (DoD) civilian employees. The thesis will focus on promotion speed and other selected job performance measures for all civilian DoD personnel employed between 1986 and 1999, except for those in the National Imagery and Mapping Agency and direct and indirect hire civilian employees outside the 50 states and the District of Columbia. The Defense Manpower Data Center (DMDC) provided the personnel data. Other performance measures that are analyzed include performance ratings, earnings and retention.

The primary question for this analysis is What is the effect of graduate education on the job performance of DoD civilian employees? The secondary questions that reinforce the primary question are: (1) Does the possession of a Master’s degree result in faster promotion, higher earnings, and better performance ratings? (2) Does the effect of a Master’s vary among DoD occupations and functional areas? (3) Does the DoD personnel structure reward the investment in human capital represented by the Master’s degree?

DoD civilians are paid according to commonly structured pay tables. The largest portion of DoD civilian employees, especially white-collar personnel, is covered by the General Schedule (GS) pay system. This system is built on the concept that equal payment will be provided for equal work and that salary differences between non-federal employees and DoD employees will be compared periodically. Yet a commonly asked question is whether the common pay table is sufficient enough to attract, motivate, and retain highly educated and high quality personnel who have other opportunities in the civilian market. This thesis will research whether more highly educated civilian employees are paid more and are promoted faster. It will also examine their retention behavior.

In September 1999, Usan and Utoglu [Ref:7] analyzed the effect of graduate education using the same database. However, to obtain a different perspective of the effects of graduate education on DoD civilian employees' performance, this thesis analyzes the same performance measures, but uses different methodologies. Usan and Utoglu used three bivariate logit models to estimate promotion, retention and performance ratings models. In addition, they estimated the level of employee salaries using a semi-log model. The pay, promotion, retention and performance evaluation models estimated in this thesis will be specified differently from those estimated by Usan and Utoglu. The differences between this thesis and the research by Usan and Utoglu are explained below.

To analyze promotion outcomes, Usan and Utoglu analyzed current civilian employees in the DoD as of 1986 and followed them until 1992. A dummy variable was created based on whether the employees were promoted at least once during this six-year period. This outcome of at least one promotion in a six-year period was used as criterion for tracking the effect of graduate education on performance. However, a superior measure of promotion would be to measure promotion speed or the number of promotions over a given period rather than defining promotion based on only a single promotion incident over such a long period.

As a measure for retention, Usan and Utoglu analyzed the retention behavior of DoD employees between 1986 and 1992. If the employees were still in the federal service in 1992, then they were coded as stayers. This methodology also did not analyze the length of service of employees before separation.

As a third measure of performance, Usan and Utoglu used the average performance rating of employees between 1986 and 1992. Since little variation was observed in performance ratings among employees, the results might not provide precise estimates of the relationship between graduate education and performance ratings. Therefore, this thesis identifies superior performers as those who receive the highest performance ratings. Also, high performing employees are often placed in supervisory positions as a reward for their performance. Therefore, when workers are promoted to supervisors, this can be a useful performance measure.

Lastly, Usan and Utoglu analyzed the 1986-year salary level. However, the percentage increases of salary overtime in real terms may indicate the impact of graduate education on earnings more accurately.

B. BACKGROUND

In this section the basic personnel management system for DoD civilian personnel is reviewed to understand the performance, promotion, and pay systems. This information is useful background for understanding the models presented in this thesis.

1. Pay systems of DoD civilians

Federal government employees in the Executive Branch [Ref:10] are paid according to various pay systems. Most federal employees are paid under one of two main government pay systems: (1) the "general schedule" (GS) pay system, which sets specific salary levels for federal white collar workers, or (2) the "wage system rates" which are paid to the government's craft and trade (blue-collar) workers. The GS pay system covers approximately half of the federal workforce [Ref:11].

The general schedule is composed of 15 grades, or salary levels. Each grade includes ten steps through which employees advance based on satisfactory job performance and length of service. For all GS grades, Table 1 shows the waiting periods for advancement to each higher step. Employees who have not reached the highest step for a particular position are generally advanced to the next step when they complete the required waiting period. This is true only if the employee's rating of record for the most recently completed appraisal period is rated at least "Fully Successful" or equivalent, and also if no equivalent increase was received during the waiting period. Supervisors of other GS employees are ordinarily classified at least one grade higher than their subordinates. However, this doesn't necessarily mean that supervisors will be paid more than all of their subordinates.

For GS employees, two types of annual pay adjustments exist: (1) a national, across-the-board increase; and (2) a locality-based pay adjustment. The annual across-the-board increase is normally paid in January of each year (along with the locality pay adjustment). The amount of this increase is normally based on the annual percentage change in the Employment Cost Index (ECI). The ECI is a statistical indicator, which the Bureau of Labor statistics maintains, and measures changes in private sector labor costs. Similarly the locality-based pay adjustments are designed to address a gap between federal and civilian salaries that White House and congressional leaders feel impose a hardship on employees and leave the government unable to compete in the labor market.

Table 1. Step Increases of GS Personnel

From Step	To Step	Weeks
1	2	52
2	3	52
3	4	52
4	5	104
5	6	104
6	7	104
7	8	156
8	9	156
9	10	156

Source: From [Ref: 9:p.31]

When an employee is promoted or transferred from a position in one GS grade to a position in a higher GS grade, the individual is entitled to basic pay at a rate not less than *two step-increases* (within-grade) above the employee's original basic rate of pay before the promotion. In other words, a GS-4, step 5 must receive, as a minimum, the pay of a GS-4, step 7 upon promotion to GS-5.

In contrast to the GS pay rates; the pay of federal government's wage-system employees is fixed as an hourly rate by the lead agencies. Pay rates for wage system employees are set as an hourly rate and are legally required to be adjusted from time to time consistent with prevailing rates. The wage system's prevailing rate determinations are made on the basis of surveys of rates paid by private employers in each local area for work similar to that performed by federal wage employees. There are around 133 local wage areas. Each wage area pay scale is divided into three classes: WG (worker); WL (leader); WS (supervisor). The WG and WL classes of pay rates each have 15 grades with 5 steps in each.

2. Promotions in the Federal Service

A promotion is a change to a higher grade and should not be confused with periodic "within-grade increases" or "quality step increases," which provide salary increases within the scheduled rates of the grade. Opportunities for advancement occur when new positions are established because of reorganization, added program responsibilities, or when an employee vacates a position. Competition among employees is generally required [Ref:11: p.230].

For promotion from one position to another, the employees should also meet time-in-grade requirements. For example, for advancement to positions at GS-12 or above, the candidate must have completed a minimum of 52 weeks in a position no more than one grade lower than the position to be filled. For advancement to positions at GS-6 through GS-11, candidates must have completed again a minimum of 52 weeks in a position no more than one or two grades lower depending on the position grade intervals. Advancements to positions up to GS-5 have no restrictions if the employees completed 52 weeks in the lower grades.

Each agency must have a Merit Promotion Plan complying with the requirements of the Office of Personnel Management (OPM). The main purpose of the Merit Promotion Plan is to ensure the selection of the best-qualified candidates to open positions. Merit promotions should not be confused with within-grade pay increases, as they involve a formal move to a higher grade [Ref:10: p.159].

A candidate selected for a first-level supervisory or managerial job must serve a probationary period of one year. The probationary period for new managers and supervisors is intended to assess their supervisory and managerial skills and abilities, *not* to test them on technical or program knowledge. First-time supervisors and managers who do not satisfactorily complete the trial period will be returned to positions of no lower pay and grade than those they occupied before assuming their management or supervisory assignments.

Although all promotions must follow merit procedures, they do not all require competition among employees. Some jobs are filled by “career promotion.” For example, if an employee has been selected competitively for a trainee or understudy position, or for another position with a known promotional potential or career ladder, which provides for consecutive promotions, and the employee performs satisfactorily then the employee is eligible for promotion without additional competition until the full performance level of the position is reached.

3. Performance appraisal systems

Federal employees are subject to periodic appraisals of their job performance. The rating levels are shown in Table 2. DoD civilians are classified according to five different rating levels. These performance appraisal levels can have an impact on a wide variety of personnel and employment decisions affecting federal employees. For example, employees can be reassigned, demoted, promoted, or removed from the job if the individual continues to have “Unsatisfactory” performance. The appraisal systems must be based on objective job related criteria, and performance standards must be developed for each element of the job on which an employee is evaluated. If an employee’s most recent rating of record (formal summary rating) is below Fully Successful (level 3), the agency is required to deny the employee’s within-grade increase.

Table 2. Performance Appraisal Levels

Levels	Meanings of Codes
1	Outstanding
2	Exceeds Fully Successful
3	Fully Successful
4	Minimally Successful
5	Unsatisfactory

Source: From [Ref: 7]

C. ORGANIZATION OF THE THESIS

This thesis is organized into five chapters. Chapter II briefly reviews studies of the relationship between human capital and job performance of individual companies. Also this chapter summarizes the analyses of DoD employees' job performance. Chapter III describes the data set used in this thesis and explains the methodologies used to model promotion speed, the length of time to separation, and annual salary increases. Chapter IV estimates the performance models and describes the results of the performance models. Chapter V summarizes the results of the analysis and makes recommendations for further research.

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II. LITERATURE REVIEW

A. PREVIOUS STUDIES OF GRADUATE EDUCATION

No completely satisfactory method of measuring job performance, or even defining it, seems to exist. According to human capital theory, an individual's productivity and earnings increase with additional education. Yet studies have not been able to discriminate between the various and often contradictory explanations for the positive relationship between earnings and education. Some questions about the effect of education on job performance have been posed in the literature. For example, does academic education really develop the personal capacities of employees, or does it only serve as an element of a screening process, which signals employers about the skills of individuals who are inherently more productive? Owing to such questions, many researchers have examined the benefits to employees of seeking higher education. In their studies, they have found some contradictory results on the effects of education on job productivity. Some researchers have found a high correlation between academic achievement and job performance. Others have suggested that education only provides credentials or signal, which help the firm to filter job applicants.

David A. Wise, intrigued by these problems, conducted two studies on job performance [Ref:1]. In his first study he wanted to answer two main questions. (1) Was academic achievement related to job performance? (2) Was this relation due to personal characteristics or other cognitive skills gained in school?

To find answers, Wise estimated a salary model with ordinary least squares. The explanatory variables basically included the level of education, the type of education, prior employment experience, academic achievement, and other personal characteristics, namely leadership ability, socioeconomic background, and desire for job security. The results showed that nonacademic attributes were as important as academic abilities in determining job performance. He found leadership ability and initiative were positively related to job performance while he observed a negative relationship between performance and an individual's desire for job security and job success. Graduate education was also correlated with higher job performance in accordance with human capital theory. Employees with graduate degrees and who were at the top 5% of their class received the highest salary increases in the model.

In his second study, David A. Wise [Ref:2] asked the same questions as in his previous study with the same data and explanatory variables, but unlike his first study, he used maximum likelihood techniques to estimate the relation between promotion and education. He thought that the rate of upward movement of an individual might be a more direct measure of job performance than the rate of salary increase. One problem with using salary is that salaries are assigned to positions rather than to individuals. Therefore, salary does not accurately indicate an individual employee's performance. Second, salary was automatically increased based on years employed even if the employee was not promoted from one level to the next.

Wise's results were, however, consistent with his previous study. The estimated coefficient had the same sign and similar magnitude in both studies. A graduate degree had a greater effect on the promotion probability than it had on salary even for the employees ranked at the bottom of the class. In both of Wise's studies, the hypothesis of "no relationship between education and job performance" was rejected. Also nonacademic characteristics proved to be as important as the effect of academic achievement on job performance.

James L. Medoff and Katharine G. Abraham found some interesting results that appeared to contradict human capital theory [Ref:3;Ref:4]. They wanted to learn whether additional earnings resulting from more human capital could be explained by higher job productivity. In their first study [Ref:3], they built a semi-log salary model. The data was obtained from a computerized personnel file of a large U.S. manufacturing firm. The data consisted of white males and included information on: the employee's education, length of service, date of birth, physical work location, current job grade, date of entry into current job grade, current salary, and recent salary. Also, the data included two measures of the employee's performance and assessment of the employee's potential for advancement. The firm, which Medoff and Abraham selected for their study, did not use a classical supervisor ranking system. Rather, performance evaluations were based on the consensus of a committee of supervisors who evaluated each employee relative to a group of his or her peers. In their study, basic salary was the only payment to the employees; no employees received any bonuses or other payments, which could bias the salary results.

The explanatory variables in the salary model included the level of education, pre-company experience, company service, performance ratings, grade level dummies, and region dummies. Medoff and Abraham ran the models three times. In the first run, they excluded grade dummies and the performance rating. In the second run, they added the grade level to determine the difference in every grade level. Lastly, in their third run, they included both grade levels and performance ratings to analyze the independent relation between performance and the other explanatory variables.

In the first model, the estimation results were consistent with human capital theory. Employees having a high school diploma or less received 13% and 23% lower earnings compared to college graduates. Having a Master's degree or doctorate increased earnings 10% and 21%, respectively. Pre-company experience and years in service were also positively related to salary.

In the second model, which included grade levels, the coefficients of the education variable dropped significantly. The effect of a Master's degree on salary fell from 10% to only 2%, which indicated that the Master's degree holders were assigned to jobs in higher grades. Similarly, pre-company experience and years in service also lost some of their effects on the salary. Lastly, before adding the performance ratings to the model, Medoff and Abraham assumed that if a relationship existed between performance ratings and earnings, then the coefficients of education and the other variables in the model would drop to zero. When the third model was run, the results were similar to the second model, which implied that performance ratings could not explain the effect of the explanatory variables, such as education, pre-company experience, and years in service.

In their second study, [Ref:4] Medoff and Abraham also analyzed the relation between experience and job performance using cross-sectional longitudinal data. They used performance rating as an indicator of job performance. They explored whether higher relative earnings indicated that more experienced managers and professionals were relatively more productive than their less experienced peers. The same data from the first study were used in their second study.

Using cross-sectional data Medoff and Abraham [Ref: 4] built a semi-log salary model. The results were similar to their first study. When the model controlled for grade level, the coefficients of education dropped significantly from 10% to 2% for a Master's and from 24% to 5% for a Doctorate. But when the performance rating dummies were introduced into the model within grade levels, the coefficients did not move toward zero. This result implied that managers and professionals who received higher earnings performed no better than less senior managers and professionals in the same grade levels. So this result was not consistent with the usual human capital or on-the-job training model.

In their longitudinal data between 1972 and 1976, two separate salary variables and two separate performance variables were modeled. It was observed that for those remaining in a given grade level, the passage of time affects "within-grade-level salary position" much differently than it affects "within-grade-level performance position." Over time, while employees did not change grade levels, "within-grade-level salary" appears to rise substantially, while relative "within-grade-level performance" appeared to remain roughly stable or deteriorated. Again these results were contrary to the human capital explanation of the experience-earnings profile.

William R. Bowman and Stephen L. Mehay [Ref:6] analyzed the relationship between on-the-job productivity and graduate education. The study used the promotion of Navy officers as the performance measure. A probit model estimated the promotion probability. Bowman and Mehay used a unique data consisting of 4,471 professional and technical officers in the Navy's Promotion History File between 1985 and 1990. This data, which provided background information, were augmented with supervisors' evaluations (fitness reports) prior to the grade 4 promotion level. Officers were classified in two categories: line and staff. Line officers work in primary occupations like aviation, ship, and submarine operations. Staff officers are generally in administrative jobs. The career paths and the difficulty of jobs are similar within occupational categories. The officers were evaluated or promoted according to their relative performance within their own communities (occupational category). Since the Navy personnel system is characterized by an internal labor market with a vertical hierarchy, promotion to grade 4 is the first significant control point in an officer's career and involves an up-or-out decision.

When Bowman and Mehay estimated a single-stage grade 4 promotion model, they noticed that officers with any graduate education were more likely to be promoted. They questioned whether graduate education was the sole cause or whether other unobserved cognitive and affective skills caused an officer to select the Navy-funded, full-time graduate education program. Is so, self-selection would bias the effect of education on the officer promotion probability. Two sources of selection were discussed. First, a potential administrative bias existed because the Navy chose officers for graduate education according to their abilities. Second, officers chose to attend graduate education on the expectation that the benefits (higher promotion probability) would be greater than the costs of additional service time. Both selection sources could create a self-selection bias in the single-stage promotion model.

In the promotion model, cognitive abilities were specified as a function of college grade point average, a technical undergraduate degree in science, engineering, or mathematics, or a graduate degree. Affective skills were represented by the accession source (the Naval Academy, an ROTC scholarship, the Officer Candidate School (OCS), or the enlisted ranks). The model also included demographic factors, such as sex and race, marital and family status, and fiscal year dummies. To be able to eliminate selection bias, the authors introduced controls to the model for academic background and early career performance. These controls were proxied by college GPA and early performance rating scores (based on being recommended for early promotion). When these controls were included in the model, the coefficient of the Master degree dropped 20%.

In addition to these controls, the authors also used a bivariate probit model to include the portion of each person's preferences for education not captured by the GPA and early performance rating proxies, which were correlated with the actual possession of a graduate degree but not with promotion. To be able to capture that bias, they used a probit model for the determinants of graduate school attendance. The attendance depended on the expected returns and individual characteristics such as sex, age, marital status, and race/ethnicity. Since the cost of attending a graduate program varied across occupational specialties, the sub-specialties within line and staff occupations were also included in the model. In some specialties, leaving the operational environment to attend graduate school is very costly. In other specialties because of strong civilian career opportunities, the opportunity cost of attending graduate school is quite high. Therefore, personal preferences were proxied by information in the data file about whether each officer would accept an offer to attend graduate school if he or she were offered the program.

The two-stage bivariate probit results indicated that a large part of the promotion effects in the single-stage models was due to the selection of more able officers into the graduate education program. The positive selection effect also varied in two broad occupational areas. For line officers, the Master's coefficient in the bivariate model was 25% smaller than in the single-stage model; for staff officers the Master's coefficient fell 50%.

In the same study, Bowman and Mehay analyzed the effect of a fully funded graduate program. Because the fully funded program generally provided firm specific training, they tested whether the impact of a Master's on promotion was due to the firm-specific training or to general training. Bowman and Mehay ran the single-stage probit models and the bivariate probit models for any Master's degree and they ran the models for government-funded degrees. In both cases, the comparison group consisted of those without a Master's.

In Table 3 and Table 4 (compare column 1 of each table) the return to a funded Master's for line officers is nearly double that for any Master's. For staff officers, the return is 20% higher than for any Master's degrees. These tables also indicated that the selection bias was greater for the Navy funded graduate programs than for any other Master's program. When the single-stage model controlled for performance and ability, the return to the Navy funded Master's for line officers decreased about one-half, whereas it only dropped about one-third for any other Master's; for staff officers, the return to any Master's was reduced by two-thirds in Table 3. However, the return to funded Master's was reduced by nearly three-quarters in Table 4. From these results, it was concluded that both firm-specific and general types of investments provided a positive return to officers in the Navy.

Table 3. Coefficient of Any Master's Degree in Single-Stage and Bivariate Probit Models

	(1) No Controls for Ability/Performance	(2) Controls for Ability/Performance	(3) Bivariate Probit
Line Officers	0.376 (0.073)[a] [0.098][b]	0.265 (0.065) [0.065]	0.198 (0.077) [0.056]
Staff Officers	0.503 (0.063) [0.145]	0.376 (0.073) [0.089]	0.188 (0.108) [0.051]

Source: From [Ref:6]

[a] Standard errors in parentheses.

[b] Marginal effects in brackets.

Table 4. Coefficient of Fully-Funded Master's Degree in Single-Stage and Bivariate Probit Models

	(1) No Controls for Ability/Performance	(2) Controls for Ability/Performance	(3) Bivariate Probit
Line Officers	0.605 (0.067)[a] [0.148][b]	0.460 (0.074) [0.093]	0.221 (0.037) -
Staff Officers	0.615 (0.072) [0.172]	0.440 (0.086) [0.101]	0.246 (0.048) -

Source: From [Ref:6]

[a] Standard errors in parentheses.

[b] Marginal effects in brackets

B. PREVIOUS STUDIES ON DOD EMPLOYEES

Of the various studies about the relationship between education and the job performance of DoD civilian employees, most have found a positive correlation between human capital and earnings. Yet some studies suggested that there was no relation or there was a negative relation between experience and relative earnings. Generally, such results are consistent with human capital theories.

Bruce H. Dunson [Ref:5] analyzed DoD civilian employees and the relationship between earnings, experience and productivity. Actually this analysis replicated Medoff and Abraham's studies on the employees of the previously mentioned manufacturing firms. Dunson wondered whether he would find the same results for DoD civilian employees as Medoff and Abraham found for private sector employees. He questioned whether more educated or more experienced workers earn more than less educated and less experienced employees. He also questioned whether earning differentials occurred within grade levels. Most importantly, he wanted to learn whether more educated and more experienced employees would also be more productive within grade levels.

The data were obtained from the Department of Defense Civilian Master and Transaction File. The study consisted of white male employees working full-time in either administrative or professional jobs in the DoD in grades 13-15. In his semi-log earnings model, education level, prior experience, service years and dummy variables for physical work locations of DoD employees were created. Education level was categorized into five different classes: less than high school, high school, a Bachelor degree, a Master's degree, or a professional degree and a Doctorate. He used entry age as an indicator of prior experience. Basically, Dunson followed the same methodology as in Medoff and Abraham's studies and ran the model three times. In the first run, he excluded performance ratings and grades from the model and estimated the coefficients of the explanatory variables. The results suggested that having a Master's degree had little effect on earnings. In all cases, having a Master's degree increased earnings by only 11%. On the other hand, one more year of tenure beyond the mean number of years increased earnings by 4 or 5%. In the second run, grade levels were introduced to the model. The results suggested, like Abraham and Medoff's studies, that "within-grade earnings" were consistently smaller for personnel with a Master's or professional degree compared to only a Bachelor's degree. When the second model was run with performance ratings added, Dunson observed that personnel with higher performance ratings earned more than personnel with poorer performance ratings. But the difference between earnings associated with performance evaluations was extremely low. Most importantly, no relationship was found between education and productivity. Again this result was consistent with Abraham and Medoff's studies, which contradicted the human capital theory.

In 1999, Usan and Utoglu [Ref:7] also examined the effects of graduate education on the performance of DoD personnel using several performance measures: salary level, promotion, retention, and performance rating. They estimated the salary model with the Ordinary Least Square (OLS) technique. The other models were analyzed using binary logit techniques. The same data was used in this thesis and in the Usan and Utoglu study provided by the Defense Manpower Data Center. DMDC provided two personnel files to profile DoD Civilian personnel. These two files have similar data elements. Usan and Utoglu merged the two files for personnel working in the DoD between 1986 and 1999. The data consisted of observations made on DoD employees every two years. The data were restricted to personnel with at least a Bachelor's degree.

Usan and Utoglu built a semi-log salary model to cover all employees in 1986. Background variables were included to account for differences in education. Since experience highly affected earnings, they used federal years in the federal service and prior service years as indicators of experience in the federal service. Also, because federal salaries varied across regions due to different economic conditions, regional dummy variables were included in the model. Veterans were also included in the model to capture the impact of the DoD's veteran's civilian hiring preference. To capture the differences between different occupational categories, occupational dummies were also used in the model. With the expectation that supervisory status had a positive effect on the earnings, the supervisor status variable was also added to the model.

When Usan and Utoglu ran their model without controling for grade levels, they found that personnel with a Master's or Doctorate earned 5% and 16% more, respectively, than personnel with a Bachelor's degree. In the second run of the model when grades were introduced to the model, the effect of a Master's degree and a

Doctorate fell to only 0.3% and 4%, respectively. These results suggested that the higher earnings for employees with a Master and Doctorate degree resulted because the more highly educated candidates entered at higher grades, which were correlated with higher salary. This salary model has one weakness: the authors did not attempt to track the percentage change of employee's annual salary over time.

For the promotion performance measure, Usan and Utoglu used maximum likelihood techniques to estimate the probability of a particular individual being promoted between 1986 and 1992. The basic logit equation they used can be written as follows:

$$L_i = ln\ (P_i/1-P_i) = B_0 + BX+E$$

L represented the logit, which is ln $(P_i/1-P_i)$ or the log-odds ratio of being promoted. The constant term (intercept) B_0 was the value of L if X were zero. *B* was the change in *L* for a change in *X.* X represented all the explanatory variables in the model. The authors used the *cumulative logistic distribution function* to determine the promotion probability [Ref:9]

$$P_i = 1/\ 1+e^{-\ (Bo+BX)}$$

Usan and Utoglu also looked at the promotion histories of employees between 1986 and 1992. For this period, they examined the individuals' promotion dates. If employees were promoted between these years, a binary dependent variable for promotion was created and took the value of 1; otherwise, it took the value of 0. Four specifications were examined in the model. In the first specification, they ran the model without any controls for grade levels and performance ratings. In this model, they found that employees with a Master's or Doctorate were less likely to be promoted than employees with a Bachelor's degree. Since the parameter estimates indicated the odds ratio of being promoted, the partial effects[1] were computed. Employees with a Master's degree or Doctorate were 2% and 6%, respectively, less likely to promote. But when the grade levels were controlled, the effect of graduate education on promotion became positive. This result showed that since employees with a Master's or Doctorate were initially placed in higher grades, advancing in their career path was more difficult for them.

In the third and fourth specifications of the promotion model, similar results were found as in the previous two specifications. Without control for grade levels and rating level, the parameter estimates for Master's and Doctorate's were negative but smaller than in the first specification. This implied that no relation between job performance and Master's or Doctorate's existed. Similarly, in the fourth specification when the model controlled for grades and performance ratings, the parameter estimates of the Master's and Doctorate's became positive, but with a smaller partial effect on the promotion probability than in the second specification. Generally, education was statistically significant and more educated personnel were less likely to be promoted because they started in higher-level positions. The method Usan and Utoglu used was weak because the promotion probability did not calculate the time to promotion. In a six-year period, one employee could receive more than one promotion, so this model did not capture promotion speed. The effect of a Master's might be underestimated.

Usan and Utoglu also estimated a retention model using maximum likelihood techniques. Individual characteristics like sex, race, age and veteran status were used in the retention models. Usan and Utoglu used different functional areas such as capturing to capture differences between work environments. Education levels and federal service years were also considered as well as the average performance ratings of available years. Similar to the promotion model, Usan and Utoglu tracked employees between 1986 and 1992 and examined the employee's decisions to stay or leave during this period. If

[1] The partial effect of each explanatory variable is the difference between the probability of the base case (all dummy variables set to zero and continuous variables set to their means) and the probability of the case where each explanatory variable is increased by one unit while all other variables remain at their base levels.

employees were still in the federal service in 1992, then the retention variable was coded 1; otherwise it took the value of 0. They excluded employees with more than 15 years of service from the analysis because of the powerful influence of retirement benefits on employees' stay or leave decisions.

They estimated two retention models: one for all employees and one restricted to those who were newly hired in 1986. The coefficients obtained from these two models also were converted to partial effects. Employees with a Master's or Doctorate were 1.5% more likely to leave the service compared to employees with a Bachelor's degree, holding all other variables constant. For new hires, similar results were found: both Master's and Doctorate degree holders were 5% more likely to leave the service than those with a Bachelor's degree. Consequently, these results confirmed the economic theories that the higher educated and younger employees were more mobile in the job market.

Usan and Utoglu also estimated a performance-rating model with a maximum likelihood technique. The average of all ratings between 1986 and 1994 were calculated for all employees' data and for new hires in 1986. Employees whose ratings exceeded this average were coded 1; otherwise they were coded 0 for the dependent variable. Similar explanatory variables were used for both models, but service years were not included in the model for 1986 new hires. Usan and Utoglu found that employees with a Master's and a Doctorate were significantly more likely to receive higher performance ratings than employees with a Bachelor's degree. This result supported the hypothesis that more education improved an individual's adaptability or ability to cope with job demands and became an important determinant of career success.

As a summary of all these models, Master's degree holders earned higher annual salaries and were more likely to promote. They were also more productive despite the findings of Dunson (1985) and Medoff and Abraham (1980) that there was no relation between human capital and on-the-job performance.

Lastly, Beth Asch [Ref:8] conducted a detailed study of the pay, promotion and retention of DoD civilian employees. She wanted to explore whether DoD pay and promotion systems were efficient enough to attract, to motivate and to retain more highly qualified workers. She analyzed whether higher-educated people were paid more, promoted faster and stayed longer. She used the DMDC personnel files of civil service GS personnel. The data she used tracked individuals who entered and reentered the DoD civil service between fiscal 1982 and fiscal 1996. The data consisted of information on entry characteristics, and how these characteristics varied over each individual's career, on pay levels, on promotion events and timing, and on the timing of exits from the DoD civil service. She tracked two different cohorts to explain the differences before and after the DoD personnel drawdown. The fiscal 1988 cohort included 31,912 civil service employees who entered or reentered in 1988. The fiscal 1992 cohort consisted of 19,744 civil service employees who entered or reentered in 1992.

Asch used three measures of personnel quality: education, supervisor rating and promotion speed. She also assessed the advantages and disadvantages of these measures. For example, education level was measured with error in the DMDC dataset. To eliminate possible biases related to education level, she used only the entry education level, which appeared to be measured accurately. Supervisor ratings were used to see how well employees performed in their jobs from the supervisors' perspectives. Unfortunately, such ratings did not provide much variation and were missing for those who were in their first year of service. Promotion speed provided more variation across personnel and captured how well matched the employees were with the civil service jobs. However, promotion speed was observed only for those who stayed in the service, which could lead to biased results. Someone who did not leave the service, might have a taste for the civil service, so the effects could be overstated. In her study, Asch used some statistical techniques to overcome these weaknesses.

In the salary model, she used ordinary least-squares regressions to measure the effect of education on salary. To test for biases, she analyzed each cohort to a certain point; if there were some differences in the estimates, then there could be a selection bias. She divided each cohort data into two groups: those who separated at year t, and those who stayed beyond year t. For the fiscal 1988 cohort, she estimated the results for employees who stayed until YOS 8 or beyond. For the fiscal 1992 cohort, she estimated the equations until YOS 4 and beyond. If the results did not differ much, then a selection bias was not a serious problem.

Table 5 describes the variables used in the Asch study. Table 6 displays some of her results. For the fiscal 1988 cohort, employees with a Master's degree, who stayed beyond YOS 8, earned 7.3 % more than employees with no college education. Employees with a Master's degree who separated at YOS 8 earned 5.3 % more than non-college graduates. For the fiscal 1992 cohort, similar results were estimated (see Table 6. She pointed out that the results for education might be underestimated because bonuses were excluded from the earnings measure. The names of the variables used in Asch study are listed below.

Table 5. Names of the Variables used in the Asch Study

Names	Definition
MNYOSO	Months in service at entry
MNPROM1	Months to first promotion
CUMRAT1	Cumulative fraction of "outstanding" ratings
CUMRAT2	Cumulative fraction of "exceeds fully successful" ratings
CHAVRAT	Cumulative number of years employees received ratings
DMDCVET	Prior military service
EGRADE	Entrygrade
SOMECOL	Education= Some college at entry
AADEG	Education=Associate degree at entry
BADEG	Education=Bachelor degree at entry
ABOVBA	Education=Above Bachelor degree at entry
MA	Education=Master degree at entry
PH	Education=Doctorate degree at entry
TPROM1	Months to first promotion
TPROM2	Months to second promotion
TPROM3	Months to third promotion
TPROM4	Months to fourth promotion

Source: [Ref:8]

Table 6. Ordinary-Least Squares Regression Results from Asch, by Entry Cohort (Dependent Variable = Log (Annual Salary)

	FY88 COHORT				FY92 COHORT			
	Beyond YOS 8		Left at YOS 8		Beyond YOS 4		Left at YOS 4	
	Estimate	Std. Error	Estimate	Std. Error	Estimate	Std. Error	Estimate	Std. Error
SOMECOL	0.017*	0.001	0.008	0.004	0.006*	0.003	0.021**	0.009
AADEG	0.022*	0.002	0.011	0.008	0.050*	0.005	0.047*	0.017
BADEG	0.077*	0.002	0.078*	0.006	0.062*	0.004	0.011	0.011
ABOVBA	0.107*	0.003	0.077*	0.011	0.081*	0.007	0.030	0.026
MA	0.073*	0.002	0.058*	0.009	0.056*	0.005	0.068*	0.020
PHD	0.116*	0.005	0.069*	0.019	0.078*	0.010	0.064	0.045
N	103,741		11,687		33,629		8,647	
Mean Dep. Variable	10.257		10.158		10.140		9.871	
F-Statistic	7437.688		557.763		1797.523		170.225	
R-squared	.843		.783		.785		.578	

Note: * = Statistical significance at one percent level

** = Statistical significance at five percent level

Source: [Ref:8]

To analyze promotion speed, Asch used Cox regression models of months to first promotion and months to second promotion. The promotion speed can be obtained from the Risk Ratio column of Table 7. For example, the Risk Ratio for AADG (Associate's degree) for the FY88 cohort is 1.185, which is greater than 1. This means that the probability of a first promotion is 18.5 percent higher for those with an associate degree than it is for those with no higher education. Similarly, the hazard of first promotion for employees with a Master's degree for FY88 cohort was 44.7 percent higher than employees with no higher education. The hazard of second promotion for employees with a Master's degree was still 13.4 % higher than the employees with no higher education, but the probability became smaller.

Table 7. Cox Regression Model Estimates of Months to First and Second Promotion, 1988.

	First Promotion			Second Promotion		
	Estimate	Std. Err	Risk Ratio	Estimate	Std. Err	Risk Ratio
MNYOSO	0.009*	0.001	1.009	0.023*	0.001	1.023
MNPROM1				-0.023*	0.001	0.977
CUMRAT1	0.269*	0.030	1.309	0.318*	0.034	1.374
CUMRAT2	0.125*	0.024	1.133	0.109*	0.029	1.115
CHAVRAT	0.040**	0.021	1.041	0.122*	0.035	1.130
DMDCVET	0.110*	0.026	1.116	0.033	0.036	1.034
SOMECOL	0.090*	0.020	1.094	0.065**	0.027	1.067
AADEG	0.170*	0.037	1.185	0.108**	0.050	1.114
BADEG	0.415*	0.027	1.515	0.239*	0.036	1.271
ABOVBA	0.447	0.053	1.564	0.159**	0.070	1.172
MA	0.369*	0.044	1.447	0.126**	0.061	1.134
PHD	0.275*	0.101	1.317	0.381**	0.188	1.464
N	28,350			17,423		
%Censored	35.5			39.5		
-2 log	367132.2*			169934.5*		

Note: *=significant at one percent level

**= significant at five percent level

Source: [Ref:8]

For 1992 cohort, similar results were found for first promotion and second promotion in Table 8. The probability of first and second promotion for employees with a Master's degree were 57.9% and 25%, respectively, higher than for employees with no higher education.

Table 8. Cox Regression Model Estimates of Months to First and Second Promotion, 1992

	First Promotion			Second Promotion		
	Estimate	Std.Err	Risk Ratio	Estimate	Std.Err	Risk Ratio
MNYOSO	-0.009*	0.001	0.991	0.027*	0.003	1.027
MNPROM1				0.055*	0.003	0.946
CUMRAT1	0.297*	0.039	1.345	0.135*	0.049	1.144
CUMRAT2	0.218*	0.039	1.244	0.036	0.047	1.036
CHAVRAT	-0.208*	0.043	0.813	0.065	0.065	1.067
DMDCVET	0.190*	0.037	1.209	-0.008	0.058	0.992
SOMECOL	0.247*	0.033	1.280	1.138*	0.051	1.148
AADEG	0.213*	0.060	1.237	0.067*	0.093	1.070
BADEG	0.429*	0.038	1.536	0.258**	1.107	1.294
ABOVBA	0.454*	0.078	1.574	0.258**	0.107	1.294
MA	0.457*	0.057	1.579	0.223*	0.086	1.250
PHD	0.108*	0.136	1.114	-0.228	0.392	0.797
N	16,427			7962		
%Censored	51.82			49.76		
-2 log	123849.5*			2646.42*		

Note: * =significant at one percent level

**=significant at five percent level

Source: [Ref:8]

For retention, Asch examined the length of time until separation for each cohort. She again used the Cox regression model of months until separation. In her retention model for each cohort, she analyzed two specifications. The first specification, in addition to demographics, occupations, and job locations, included three quality measures (entry education, supervisor rating, and months until each promotion). The second specification excluded months until each promotion. For 1988 cohort, when promotion speed was included in the model, the probability of separation for MA's and Ph.D.'s was 38.3% and 50%, respectively as shown in Table 9. However, the hazard of separation for a Master's or a Doctorate decreased to 26.5% and 29.3%, respectively when promotion speed was excluded from the model. This result indicated that employees who promoted slowly stayed for shorter periods. Table 10 shows similar results for graduate education for 1992 cohort that supported the lower retention of the employees in 1988 cohort.

Table 9. Cox-Regression-Model Estimates of Months to Separation, FY88 Cohort

	Includes Promotion Speed			Excludes Promotion Speed		
	Estimate	Std.Err.	Risk Ratio	Estimate	Std.Err.	Risk Ratio
CUMRAT1	0.409*	0.032	1.506	-603*	0.033	0.547
CUMRAT2	0.347*	0.028	1.415	-0.409*	0.028	0.665
TPROM1	-0.051*	0.001	0.950			
TPROM2	-0.054*	0.001	0.947			
TPROM3	-0.056*	0.001	0.910			
TPROM4	-0.094*	0.002	0.910			
MNYOS	-0.005*	0.000	0.995	-0.003	0.000	0.997
CHAVRAT	-0.201*	0.023	0.818	-1.392*	0.024	0.249
DMDCVET	-0.422*	0.025	0.656	0.010	0.025	1.010
EDMIS	0.351	0.335	1.420	-0.184	0.317	0.832
SOMECOL	0.013	0.019	1.013	0.014	0.019	1.015
AADEG	-0.017*	0.038	0.983	-0.086**	0.037	0.918
BADEG	0.135*	0.027	1.145	-0.020	0.026	0.980
ABOVBA	0.195*	0.057	1.216	0.035	0.056	1.036
MA	0.324*	0.045	1.383	0.235	0.043	1.265
PHD	0.406	0.109	1.500	0.257*	0.105	1.293
N	28,786			32,206		
%Censored	41.1			43.1		
2 log	41209			9585.4		

Note: * =significant at the 1%
** = significant at the 5%

Source: [Ref:8]

Table 10. Cox Regression Model Estimates of Months to Separation, FY92 Cohort

	Includes Promotion Speed			Excludes Promotion Speed		
	Estimate	Std.Err.	Risk Ratio	Estimate	Std.Err.	Risk Ratio
CUMRAT1	0.745*	0.043	2.107	0.065	0.039	1.067
CUMRAT2	0.718*	0.045	2.051	0.183*	0.040	1,200
TPROM1	-0.080*	0.001	0.923			
TPROM2	-0.159*	0.003	0.853			
MNYOS	-0.002*	0.001	0.998	-0.031	0.001	0.970
CHAVRAT	-1.178*	0.057	0.308	-2.976*	0.055	0.051
DMDCVET	-0.422*	0.025	0.656	0.010	0.025	1.010
SOMECOL	0.009	0.029	1.009	-0.089	0.027	0.915
AADEG	-0.052	0.056	0.949	-1.131*	0.051	0.877
BADEG	-0.043*	0.037	0.958	-0.067**	0.034	0.935
ABOVBA	0.143*	0.092	1.154	0.006	0.086	0.994
MA	0.054*	0.064	1.056	0.017	0.059	1.017
PHD	0.112	0.159	1.118	-0.106	0.144	0.900
N	17,389			19,914		
%Censored	49.88			49.7		
-2 log	131499.48*			165666.64*		

Note: * =significant at one percent
** = significant at five percent

Source: [Ref:8]

In summary, Asch's analysis of both the FY88 and FY92 cohorts indicated that higher educated employees were generally paid more. Furthermore, although employees with any college education were promoted faster than employees with no college, employees with a Master's degree or Doctorate were not found to always promote faster than those with only a Bachelor's degree. The retention of employees with a Master's or Doctorate degree was also poor for each cohort. The evidence on the retention of the employees with a Master's or Doctorate indicated that they had superior civilian job opportunities or their slower promotion speed translated into poorer retention.

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III. DATA AND METHODOLOGY

This chapter describes the data set and the methodology that guides the specification of the models. It also provides descriptive statistics for each data set used to estimate the various performance models.

A. DATA DESCRIPTION

This study uses the same data that Usan and Utoglu [Ref:7] used in their study. The data is provided by the Defense Manpower Data Center (DMDC). The DMDC data contains two different data files: (1) an inventory (current status) file, and (2) a transactions (dynamic) file. Appendix A lists the data elements that were obtained for employees. The two files provide information about DoD civilian personnel employed between 1986 and 1999, except for those employees in the National Imagery and Mapping Agency and those employed as direct and indirect hire civilian employees outside the 50 states and the District of Columbia. For this study, the two files have been merged into one file including only selected variables. This new file included only full-time, career, and career conditional employees with at least a B.A. or B.S. and who were paid under the General Schedule or General Management (GM) pay systems. The employees were tracked between 1986 and 1998 in two-year intervals. The employees' data information is available in this new file through February 1999. This file was converted into a SAS (Statistical Application Software) file for the statistical analysis.

The raw data file included 213,482 observations and 41 data elements. The data elements consisted of personal demographics and service background information such as sex, race, age, education years, veteran status, federal service years, functional areas, and work region. A full list of data elements is provided in Appendix A. In the data files some missing values and also miscoded values, which might bias the analysis, exist. For example, annual salaries in 1994 and 1996 were coded in four digits whereas all other annual salaries were coded in five digits. Therefore, some amendments have been made to the raw data. Descriptive statistics of data are provided in Table 11.

Table 11. Descriptive Statistics of DoD Civilian Personnel As of September 1986 (Inventory Data)

Variables	Classification	Number	%
Sex	Male	162,339	76.0
	Female	51,143	24.0
Race	White	178,075	83.4
	Black	17,455	8.2
	Hispanic	6,454	3.0
	Other	11,498	5.4
Veteran	Yes	79,296	37.1
	No	134,186	62.9
Agency	Army	82,129	38.5
	Navy*	62,887	29.5
	Air Force	42,546	19.9
	Other DoD	25,920	12.1
Education	BA/BS	162,165	76.0
	MA/MS	44,707	20.9
	Ph.D.	6,610	3.1
Pay Plan	GS	174,424	81.7
	GM	39,058	18.3
Supervisory Status	Yes	54,261	25.4
	No	159,221	74.6
Occupational Category	Professionals	112,318	52.6
	Administrative	74,377	34.8
	Technical	14,226	6.7
	Clerical	12,013	5.6
	Other	548	0.3

*Includes Marine Corps

Source: [Ref: 7]

B. METHODOLOGY

The purpose of this thesis is to investigate the relationship between graduate education and job performance of DoD civilian employees. Since it is difficult to measure the job performance of service employees, some imperfect measures must be used to gauge differences in employees' job performance in the DoD. These measures of job performance include real annual salary level, promotion, retention, and performance ratings.

For the salary model, the percentage increase of real annual salary is measured only for those hired in 1986. Also, the average annual salary of employees is used for the same employees hired in 1986. The salary models could only take into account basic annual salaries because bonuses were not included in the data. Therefore, the results may underestimate the effect of graduate education on pay.

The general approach for analyzing retention and promotion is to estimate binary logit models that focus on the factors that influence the probability of retention or promotion. However, these models are weak in two aspects. First, logit models consider only the occurrence of some event such as promotion or separation from the service during a fixed period, but do not consider the length of time until these events. Second, logit models do not consider censored data. On the other hand, survival analysis accounts for both the occurrence and the timing of promotions so that the variation in timing can also be explained. Furthermore, survival methods account for censored data. Censoring occurs when the data end before the event occurs. For example, in the separation case, an employee may not have separated by 1999 when the data ended. While the employee will separate from the civil service eventually, the separation event is not observed in the data. In the promotion case, censoring might occur because either the employee did not receive a promotion before 1999 or the employee might have separated before being promoted. In the former case, the employee might have been promoted after 1999, but this is not observed in the data set. Accounting for censoring is important because large numbers of observations may be censored and serious biases in logit model estimates may result. Therefore, in this thesis, both logit models and survival models are estimated to see the different effects of the same variables in two different models.

For the promotion model two different estimates are used based on employees hired in 1986. The first model, one calculates the promotion probability of employees in 1992 using binary logit model. The second model estimates the time to first promotion and the probability of promotion by survival methods.

For the retention model two models are again used to estimate the effects of graduate education and other personal traits on the voluntary retention decisions of DoD employees. The first model estimates the retention probability of employees in 1992. the second, a survival model estimates the length of time until separation and the probability of separation from the federal civilian service.

Two performance ratings models were used to estimate performance differences among employees. Since little variation in performance ratings exist, the results may not give concrete results if we use average performance ratings. Therefore, focusing on those who receive the highest performance ratings may provide substantially better results in distinguishing superior performers from the others. Also, better-performing employees often are placed in supervisory positions as a reward. Therefore, a model of the probability of being a supervisor is estimated to gauge job performance.

1. Salary Models

Numerous studies about returns to investment in human capital have demonstrated quite clearly that more educated workers earn more than those with less education. Based on the assumption that salary is one indicator of job performance, two different salary models are built to estimate the effect of graduate education. The first model estimates the average percentage salary increase of employees hired in 1986 while they were in the federal service. This model can be estimated by ordinary least square regression equations. The effects of education and other explanatory variables on salary are measured in percentages since the dependent variable is already measured as the percentage increase of salary. The equation for this model can be written as follows:

$$Y = \beta_0 + \beta_1 X + \varepsilon$$

Where

Y = real average percentage salary increase between 1986 and 1999;

β_0 = constant term;

X = a vector of explanatory variables that explains the variation inY;

β_1 = a vector of parameters to be estimated and;

ε = a random error term.

The second model estimates the average salary of employees while they are in the federal service. The average salaries are also measured in real terms. A semi-log model is specified to estimate the effect of education and other explanatory variables on salary. The equation for this model is:

$$Ln(Y) = \beta_0 + \beta_1 X + \varepsilon$$

Where

Y = average salary of employees hired in1986 for the period 1986-1999

β_0 = constant term;

X = a vector of explanatory variables that explains the variation in ln(Y);

β_1 = a vector of parameters to be estimated and;

ε = a random error term.

These two models provide a broad view of the employees' percentage salary increase and their overall average salary. With the results of these two models, we can better understand the overall salary changes of employees while they are working in the DoD civilian service, and the effect of graduate degrees.

The data is restricted to employees with a Bachelor's degree or higher so that we can compare differences among similar education levels. In both models, the same explanatory variables are used. The explanatory variables consist of background variables, education variables, regional and occupational variables. Background variables include sex and race to explain the differences between minorities and women in the quality of schooling or in the types of college majors. An education level variable is also added to the model. However, the education variable is not recorded correctly in every year of the data; therefore, only the entry education level is used as an indicator of education [Ref:8]. Also a variable for labor market experience is also added to the model with the expectation that a more experienced worker will earn more as a federal worker. As indicated in Chapter I, earnings differ across regions to compensate for different economic conditions and for differences in the cost of living. Therefore, regional variables were also added to the models. Since there are many different jobs in the DoD, general occupational variables were also included in the model to account for the effects of different occupations on earnings. Most importantly, the salary is correlated with the grade levels; therefore, the grade levels were also included in both models.

Descriptive statistics are shown in Table 12. Since the same variables are used in both models, only one table is prepared for two models.

Table 12. Variable Definitions and Descriptive Statistics for Salary Models For 1986 New Hires

Variable Names	Variable Description	Model 1 %	Model 2 %
Female	1=Female 0=Male	34.76 65.24	37.78 62.22
Black	1=Black 0=Not Black	10.00 90.00	10.19 89.81
Hispanic	1=Hispanic 0=Not Hispanic	3.50 96.50	3.58 96.42
White	1=White 0=Not White	75.98 24.02	62.21 37.79
Otherace	1=Other Race 0=Not other race	10.43 89.57	9.57 90.43
Veteran	1=Veteran 0=Not Veteran	6.88 93.22	6.91 93.09
BA86	1=Employee with a Bachelor's degree 0=Employee with no Bachelor' degree	85.23 14.77	84.46 15.54
MA86	1=Employee with a Master's degree 0=Employee with no Master's degree	12.15 87.75	12.94 87.06
PH86	1=Employee with a Doctorate's degree 0=Employee with no Doctorate's degree	2.60 97.40	2.58 97.42
Supervisor	1=Employee is a supervisor in 1986	2.36	2.81

	0=Employee is not a supervisor in1986	97.64	97.19
Profession	1=Employee is in a professional occupation 0=Employee is not in a professional occupation	60.37 39.73	56.71 43.29
Administrative	1=Employee is in an administrative occupation 0=Employee is not in an administrative occupation	22.64 77.36	21.97 78.03
Technical	1=Employee is in a technical occupation 0=Employee is not in a technical position	6.26 93.74	7.71 92.29
Clerk	1=Employee is in a clerical occupation 0=Employee is in a clerical occupation	10.11 89.89	12.79 87.21
Otherwc	1=Employee is in other white-collar occupation 0=Employee is in other white-collar occupation	0.61 99.39	0.80 99.20
Metropolitan	1=Census region is a metropolitan 0=Census region is not a metropolitan	82.47 11.53	82.49 17.51
Newengland	1=Census region is New England 0=Census region is not New England	3.40 96.60	3.85 96.15
Midatlantic	1=Census region is Mid-Atlantic 0=Census region is Mid-Atlantic	9.63 90.37	9.57 90.43
Eastnorthcent	1=Census region is East North Center 0=Census region is not East North Center	10.66 89.34	9.41 90.59
Westnortcent	1=Census region is West North Center 0=Census region is West North Center	4.12 95.88	4.17 95.83
Southatlantic	1=Census region is South Atlantic 0=Census region is not South Atlantic	30.13 79.87	31.36 78.64
Eastsouthatlan	1=Census region is East South Atlantic 0=Census region is not East South Atlantic	4.70 95.30	4.40 95.60
Westsouthatlan	1=Census region is West South Atlantic 0=Census region is not West South Atlantic	13.70 86.30	12.83 87.17
Mountain	1=Census region is Mountain 0=Census region is not Mountain	4.88 95.22	4.80 95.20
Pacific	1=Census region is Pacific 0=Census region is not Pacific	18.74 92.26	19.55 90.45
Continuous Variables		**Mean**	
Percentage Salary Increase	Real percentage salary increase of the employees between 1986 and 1999	41.11	

Ln(Average Salary)	Log of real average salary of employees		10.12
Average salary	Real average salary of employees between 1986 and 1999		26472.29
Priexp	Prior experience in years before joining in1986	7.74	8.05
Sqrpriexp	Square of prior experience	127.4	135.04
Grade86	Pay grade in 1986	7.14	7.08
		N_1=5675	**N_2=7495**

2. Promotion Models

Although past studies used earnings to measure performance, some authors indicated some weaknesses in this method and tried to find direct measures of on-the-job productivity. David A. Wise (1975) used maximum likelihood techniques to estimate a promotion probability to analyze the relation between job performance and education [Ref:2]. He thought the worker's rate of upward movement through the grades might be a more direct measure of job performance than the rate of salary increase. There was a problem with the assumption that salary is a valid job performance measure. First, salaries are given to positions rather than to individuals. Therefore, salary is not totally an indicator of employee's performance. Second, basic salary was automatically increased with years of service even if the employee was not promoted.

Two models were specified in this thesis to estimate the effect of education on the promotion probability and promotion speed. In the first model, a classical binary logit model is used to estimate the effect of education on promotion probability. In this model, employees hired in 1986 are tracked until 1992 and the model dependent variable is coded as 0 or 1, depending on the employee's promotion event. If an employee is promoted at least once before 1992, the dependent variable is coded 1. Otherwise it is coded 0. Since it requires time to promote in the DoD service, the promotion probability model analyzed a six-year period to estimate the changes in promotion. The promotion probability model can be written as:

$P\ (\text{promotion}_i) = \beta_0 + \beta X + \varepsilon$

Where

P (promotion) = the probability of promotion for employee i,

β_0 = constant term,

β = a vector of coefficients for the X variables, and

ε = an error term.

In the second model, the speed of promotion is estimated using a survival technique. In this model, the times to first and second promotion are estimated. The main advantages of this model are that it considers the censored data due to early separation, and it estimates both the promotion probability and the length of time required to be promoted to the next higher grade. The data were reorganized in order to estimate the time to first and second promotion. Since the dates of promotions are not recorded correctly in the original data, change in grades is used to indicate a promotion event and the speed of promotion. The data is tracked in two-year intervals. Therefore the time length for promotion in our data is in terms of years.

In survival analysis, the time until an event occurs is assumed to be the realization of a random process. The hazard function or hazard rate is used to describe the probability distribution of event times. The hazard function is defined as the risk of the event occurring in year t+1, given that it did not occur in month t. Formally, the hazard function, h(t), is

$h(t)=f(t)/S(t)$

with $S(t)=Pr\{T>\}$ and $f(t)=dS(t)/dt$

where S(t) is the cumulative survival function. S(t) gives the cumulative probability that event time T is greater than t. For example, T indicates the cumulative probability that an individual is promoted after month t, and f(t) is the probability-density function. The hazard function is used to describe the probability-distribution function in survival analysis because it can be interpreted as the probability an event occurs at time t given it did not occur at t-1.

In the Cox proportional–hazard model with time varying covariates, the hazard function is given by:

$$\text{Ln } p_i(t) = \alpha(t) + \beta_1 X_i + \beta_2 Z_i(t)$$

where $p_i(t)$ is the hazard of promotion for individual (i) and X_i is a vector of job and individual characteristics that are measured at entry and that do not vary with time. These characteristics include race, sex, grades at promotion, and prior work experience at entry. $Z_i(t)$ is a vector of individual characteristics that vary with time, such as the cumulative number of years for which he or she received each rating level(1 to 5).

Table 13 displays variable names, and description and the means or proportion of variables used in each of the three models. The second and third columns are similar in values since they use the same models with slightly different variables.

Table 13. Descriptive Statistics for Promotion Models

		Logit Model	**Survival Model 1**	**Survival Model 2**
Dummy Variables	**Variable Description**	**%**	**%**	**%**
Female	1=Female 0=Male	33.50 65.24	33.65 66.35	33.65 66.35
Black	1=Black 0=Not Black	10.00 90.00	9.96 90.04	9.96 90.04
Hispanic	1=Hispanic 0=Not Hispanic	3.40 96.60	3.39 96.61	3.39 96.61
White	1=White 0=Not White	75.34 24.66	75.29 24.71	75.29 24.71
Otherace	1=Other Race 0=Not Other Race	10.43 89.57	11.35 88.65	11.35 88.65
Veteran	1=Veteran 0=Not Veteran	92.19 7.81	92.29 7.71	92.29 7.71
BA86	1=Employee with a Bachelor's degree 0=Employee with no Bachelor' degree	85.08 14.92	85.27 14.73	85.27 14.73
MA86	1=Employee with a Master's degree 0=Employee with no Master's degree	12.09 87.91	11.94 88.06	11.94 88.06
PH86	1=Employee with a Doctorate's degree 0=Employee with no Doctorate's degree	2.80 97.20	2.77 97.23	2.77 97.23
Supervisor	1=Employee is a supervisor in 1986. 0=Employee is not a supervisor in 1986.	2.77 97.33	2.70 97.30	2.70 97.30

Ratingbest	1=Average rating is 1 and 2 (outstanding) between 1986 and 1992. 0=Average rating is 3, 4, and 5(average and bad) between 1986 and 1992.	50.02 49.98		
Profession	1=Employee is in a professional occupation. 0=Employee is not in a professional occupation.	60.18 39.82	60.30 39.70	60.30 39.70
Admin	1=Employee is in an administrative occupation. 0=Employee is not in an administrative occupation.	22.96 77.04	22.82 87.18	22.82 87.18
Technical	1=Employee is in a technical occupation. 0=Employee is not in a technical occupation.	6.47 93.53	6.44 93.47	6.44 93.47
Clerk	1=Employee is in a clerical occupation. 0=Employee is not in a clerical occupation.	10.11 89.89	9.91 90.09	9.91 90.09
Otherwc	1=Employee is in other white-collar occupation. 0=Employee is not in other white-collar occupation.	0.61 99.39	0.50 99.50	0.50 99.50
Fleet	1=Functional area is fleet. 0=Functional area is not fleet.	7.45 92.55	7.46 92.54	7.46 92.54
Intel	1=Functional area is intelligence. 0=Functional area is not intelligence.	6.34 93.76	6.63 93.37	6.63 93.37
Material	1=Functional area is material. 0=Functional area is not material.	50.98 49.02	50.10 49.90	50.10 49.90
Trainning	1=Functional area is training. 0=Functional area is not training.	3.58 96.42	3.54 96.46	3.54 96.46
Medical	1=Functional area is medical. 0=Functional area is not medical.	3.09 96.91	3.04 96.97	3.04 96.97
Headqrt	1=Functional area is department headquaters. 0=Functional area is not department headquaters.	2.86 97.14	2.86 97.14	2.86 97.14
Adminact	1=Functional area is administrative	34.60	22.82	22.82

	activities. 0=Functional area is not administrative activities.	65.40	87.18	87.18
Grade1	1=Pay grades are between 1 and 5 in 1986 0=Pay grades are not between 1 and 5 in in 1986.	27.50 72.50		
Grade2	1=Pay grades are between 5 and 9 in 1986. 0=Pay grades are not between 5 and 9 in 1986.	70.65 29.35		
Grade3	1=Pay grades are between 10 and 13 in in 1986. 0=Pay grades are not between 10 and 13 in 1986.	1.13 98.87		
Grade4	1=Pay grades are between 14 and 15 in 1986 0=Pay grades are not between 14 and 15 in 1986.	0.20 99.80		
Promote92	1=Promoted at least once before 1992 0=Not promoted	87.91 12.09		
1st Promote	1=The percent of 1st promotion between 1986 and 1999 0=Censored due to early dropout		96.49 3.51	
2nd Promote	1=The percent of 2nd promotions between 1986 and 1999 0=Censored due to early dropout			94.03 5.97
Cumrat1	The ratio of getting 1(excellent) over total ratings		18.88	23.00
Cumrat2	The ratio of getting 2(good) over total ratings		36.21	38.06
Continuous Variables		**Mean**		
Time1	Average time to first promotion (in years)		2.92	
Time2	Average time from first to second promotion (in years)			3.29
Grade1	Average grade at first promotion		8.62	
Grade2	Average grade at second promotion			9.10
Priexp	Prior experience in years before joining in 1986	8.17	8.08	8.08
Sample Size		**(N=4498)**	**(N=4570)**	**(N=4570)**

3. Retention Models

Previous analyses have shown that the effect of personnel quality and education on retention is ambiguous and cannot be predicted a priori. That is, theory cannot predict whether higher educated personnel are more likely to stay in the civil service or less likely [Ref: 12]. The reason is that higher-quality personnel have better opportunities than lower-quality personnel, both inside and outside the civil service. Whether higher quality personnel are more likely to stay or to leave depends on the incentives inside or outside the service. On the other hand, employers want to keep qualified and experienced employees in their workforce. This is true because qualified and educated workers are helpful in increasing job productivity and decreasing the manpower costs.

Some studies suggested that the turnover rate in the federal service is lower compared to the civilian sector. In 1987 Richard A. Ippolito conducted a study analyzing quit rates in the federal government [Ref:13]. In his study he suggested that the federal pension system imposed large penalties on workers who quit early because the portion of pay in the form of pensions was much higher for federal workers than comparable non-federal workers. As a result, the quit rate was lower for federal employees.

Two retention models were specified to analyze the effect of graduate education on retention of DoD civilian employees with the expectation that employees will act as utility maximizers. This theory supports the idea that employees would prefer to stay in the civilian service if the value of continued federal service exceeds the value of a job in the private sector.

The variables that are assumed to affect retention are mainly personal and job characteristics. Consequently, the model includes variables related to personal characteristics such as sex, race, age, and veteran status. Education, veteran status and performance rating are included in the model. Other variables are added to the model to control for functional areas and regional location.

The first retention model is estimated using a binary logit technique for employees hired in 1986. In this model, employees are followed until 1992 to see whether they are still in the service or not. If they are still in the service, the dependent variable is coded 1. Otherwise it is coded 0. The basic binary logit model can be written simply as follows:

P (retention) = $\beta_0 + \beta X + \varepsilon$

Where

P (retention) = the probability of staying for employee i,

β_0 = constant term,

β = a vector of coefficients for the X variables, and

ε = an error term.

The second retention model is a survival model based on a Cox regression. In this model, the time to separation is estimated. The data sample contains employees hired in 1986. These employees are tracked up to 1999, the end of the data. During this 14 year-period, snapshots of employees were taken every two years, except for the last year, 1999. Since Cox regression also takes into account the censored elements, employees who are not separated at the end of the data are used to indicate censored data. The dependent variable is characterized by the time to separation in years. The explanatory variables consist of personal characteristics such as sex, race, education, occupation variables, supervisory position and veteran status. are added to the model. The Cox regression model can be written in equation as follows:

$$\ln S_i(t) = \alpha(t) + \beta_1 X_i + \beta_2 Z_i(t)$$

where $S_i(t)$ is the hazard of separation for individual (i) and X_i is a vector of job and individual characteristics that are measured at entry and that do not vary with time. These characteristics include race, sex, and prior work experience at entry. $Z_i(t)$ is a vector of individual characteristics that vary with time, such as the cumulative number of years for which he or she received each rating level (1 to 5) until separating or the data ends. Table 14 presents descriptive statistics of the variables used for the retention logit and the survival model.

Table 14. Descriptive Statistics for Retention Models

Dummy Variables	Variable Description	Logit Model %	Survival Model %
Female	1=Female 0=Male	36.34 63.66	40.00 60.00
Black	1=Black 0=Not Black	10.26 89.74	10.64 89.36
Hispanic	1=Hispanic 0=Not Hispanic	3.72 96.28	3.84 9.97
White	1=White 0=Not White	75.86 24.14	75.55 24.45
Otherace	1=Other Race 0=Not Other Race	10.15 89.85	9.97 80.03
Veteran	1=Veteran 0=Not Veteran	7.26 92.74	7.26 92.74
BA86	1=Employee with a Bachelor's degree 0=Employee with no Bachelor' degree	84.47 15.53	84.50 15.50
MA86	1=Employee with a Master's degree 0=Employee with no Master's degree	12.74 87.26	12.82 87.18
PH86	1=Employee with a Doctorate's degree 0=Employee with no Doctorate's degree	2.78 97.22	2.67 97.33
Supervisor	1=Employee is a supervisor. 0=Employee is not a supervisor.	2.81 97.29	3.17 96.83
Profession	1=Employee is in a professional occupation. 0=Employee is not in a professional occupation.	59.23 41.77	57.08 42.92
Admin	1=Employee is in an administrative occupation. 0=Employee is not in an administrative occupation.	21.92 88.08	21.39 88.61
Technical	1=Employee is in a technical occupation 0=Employee is not in a technical position	7.30 92.70	8.66 91.34
Clerk	1=Employee is in a clerical occupation 0=Employee is not in a clerical occupation	10.86 89.14	12.13 87.87
Otherwc	1=Employee is in other white-collar occupation. 0=Employee is not in other white-collar occupation.	0.60 99.40	0.70 99.30
Fleet	1=Functional area is fleet.	6.97	11.88

	0=Functional area is not fleet.	93.03	88.12
Intel	1=Functional area is intelligence. 0=Functional area is not intelligence.	5.97 94.03	5.82 94.18
Material	1=Functional area is material. 0=Functional area is not material.	47.61 53.39	44.23 55.77
Trainning	1=Functional area is training. 0=Functional area is not training.	4.56 95.44	4.39 95.61
Medical	1=Functional area is medical. 0=Functional area is not medical.	5.94 94.06	5.50 94.50
Headqrt	1=Functional area is department headquarters. 0=Functional area is not department headquarters.	3.06 96.94	2.94 97.06
Adminact	1=Functional area is administrative activities. 0=Functional area is not administrative activities.	25.87 74.13	25.19 74.81
Retent92	1=Still in the servce in 1992 0=Left the service before 1992	71.18 28.82	
Sepevent	1=Separated from the service before 1999 0=Censored due to the end of data		50.8 49.02
Cumrat1	The ratio of getting 1 (Outstanding) over total ratings		21.86
Cumrat2	The ratio of getting 2(good) over total ratings		27.32
Continuous Variables		**Mean**	
Ratingtop	1=Average rating is below 3 (the best) between 1986 and 1999. 0=Average rating is 3, 4, and 5 (average and bad) between 1986 and 1999.	1.29	
Time	Average time of staying in the service		9.905
Age86	Employees' age at entry in 1986	30.50	30.51
Sample Size		**N=6177**	**N=6800**

4. Performance Rating Model

Performance ratings are done every year in the DoD civilian service. The ratings are a report of the job performance of the employee for the year. But the ratings might not reflect the true performance of the employee's performance due to the subjectivity of the evaluations. According to Muchinsky, [Ref:14] there are three common weaknesses of supervisor or manager evaluations of their employees. First, since employees are evaluated by many managers, varying ratings may be observed even for the same job performance. Some managers or supervisors are very strict raters while others are lenient raters. Therefore, ratings might be overestimated or underestimated due to the subjectivity of managers.

Second, the employee's characteristics may influence the raters. The employee might have a good rapport with the manager due to the personal characteristics of the employee or vice versa. This relationship then affects the perceptions of the manager about the employee's job performance. As a result, the rater may tend to evaluate the employee very good or very bad according to his one-sided perception of an employee.

Third, some managers tend to avoid trouble by not giving high or low grades. In this case, managers do not want any trouble ensuing from the evaluations. The rater may give middle level ratings to keep themselves in a safe position.

Despite all these weaknesses, performance ratings are important indicators of an employee's performance. Employees are classified or at least promoted according to the results of these ratings. Therefore, I have built two models to see the effect of personal and job characteristics on ratings. The first model analyzes the percentage of "excellent" ratings. The regression model is used to estimate the effect of graduate education and other personal characteristics on the ratio of cumulative rating 1 (Outstanding) over total ratings as a dependent variable for the six-year period. The model can be written as follows:

$$Y = \beta_0 + \beta_1 X + \varepsilon$$

Where

Y = the ratio of getting 1(outstanding) over total ratings until 1996 for employee i,

β_0 = constant term,

β_1 = a vector of coefficients for the X variables,

X = the variables that have effect on performance rating, and

ε = an error term.

The second model is built to differentiate whether employees hired in 1986 reached supervisor status. To be selected as a supervisor, employees must prove their ability and skill at their jobs. Therefore, being a supervisor can be an indicator of job performance. The binary logit model is used to see the effect of graduate education on being selected for a supervision job. Employees hired in 1986 are tracked until 1992. If the employee is selected to be a supervisor during this period, then the dependent variable is coded 1; otherwise it is coded 0. The model can be described as follows:

$$P\,(\text{Supervisor}_i) = \beta_0 + \beta_1 X + \varepsilon$$

Where

P (Supervisor) = the probability of being a supervisor for employee i,

β_0 = constant term,

β_1 = a vector of coefficients for the X variables,

X = the variables that affects being a supervisor, and

ε = an error term.

Descriptive statistics for the variables used in the rating models are displayed in Table 15.

Table 15. Descriptive Statistics of Performance Ratings Model

		Regression Model	**Logit Model**
Explanatory Variables	**Variable Description**	**%**	**%**
Female	1=Female 0=Male	41.50 58.50	32.99 67.01
Black	1= Black 0=Not Black	10.57 89.43	10.80 89.20
Hispanic	1=Hispanic 0=Not Hispanic	3.80 96.20	3.46 9.54
White*	1= White 0=Not White	76.23 23.77	74.10 25.90
Otherace	1=Other Race 0=Not Other Race	9.38 90.62	11.61 88.39
Veteran	1=Veteran 0=Not Veteran	7.10 92.90	7.23 92.77

BA86*	1=Employee with a Bachelor's degree 0=Employee with no Bachelor' degree	83.93 16.07	84.10 15.90
MA86	1=Employee with a Master's degree 0=Employee with no Master's degree	13.46 86.54	12.62 87.38
PH86	1=Employee with a Doctorate's degree 0=Employee with no Doctorate's degree	2.59 97.41	3.26 96.74
Supervisor	1=Employee is a supervisor. 0=Employee is not a supervisor.	3.26 96.84	
Profession*	1= Employee is in a professional occupation. 0= Employee is not in a professional occupation.	53.92 46.08	57.08 42.92
Admin	1=Employee is in an administrative occupation. 0=Employee is not in an administrative occupation.	21.72 88.28	21.39 88.61
Technical	1=Employee is in a technical occupation. 0=Employee is not in a technical position.	9.29 90.71	8.66 91.34
Clerk	1=Employee is in a clerical occupation 0=Employee is not in a clerical occupation	14.30 85.70	12.13 87.87
Otherwc	1=Employee is in other white-collar occupation. 0=Employee is not in other white-collar occupation.	0.75 99.25	0.70 99.30
Fleet	1=Functional area is fleet. 0=Functional area is not fleet.	13.05 86.95	11.88 88.12
Intel	1=Functional area is intelligence. 0=Functional area is not intelligence.	5.64 94.36	5.82 94.18
Material*	1=Functional area is material. 0=Functional area is not material.	41.96 58.04	44.23 55.77
Trainning	1=Functional area is training. 0=Functional area is not training.	4.09 95.91	4.39 95.61
Medical	1=Functional area is medical. 0=Functional area is not medical.	5.72 94.28	5.50 94.50
Headqrt	1=Functional area is department headquarters. 0=Functional area is not department headquarters.	3.21 96.89	2.94 97.06
Adminact	1=Functional area is administrative activities. 0=Functional area is not administrative activities.	26.29 73.71	25.19 74.81
Cumrat**	The ratio of getting 1 (Outstanding) over total ratings between 1986 and 1994	13.93	21.86
Sample Size		**N=7811**	**N=2970**

*Base variables

** Dependent variable

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IV. RESULTS OF PERFORMANCE MODELS

This chapter presents the results of four different performance models: salary, promotion, retention, and performance ratings presented in Chapter III. Each model explains separately the statistical significance of the explanatory variables, the effects of these variables on the performance measures, and the significance of the overall model.

A. RESULTS OF SALARY MODELS

Two salary measures were used to estimate the effect of graduate education on the earnings of the DoD civilian employees. The first model examines the average percentage salary increases of employees hired in 1986 and who remained employed in the federal service until 1999. In this model those who are miscoded in the salary percentage increase are deleted leaving 5,675 observations. The first model is estimated by ordinary least squares techniques. The effects of education and other explanatory variables on salary are measured in percentages since the dependent variable is already measured as the percentage increase of salary. The results of the salary change model are shown in Table 16.

The second model estimates the effect of education on the average salary of employees while employed in the federal service. Average salaries are also measured in real terms. A semi-log salary model is specified to estimate the effect of education and other explanatory variables on average salary. Employees who were hired in 1986 are used in the model providing 7,495. The interpretation of the coefficients of the independent variables is easy to understand since a one-unit change in the explanatory variables will affect the dependent variable in percentage terms. Specifically, a one-unit change will affect the dependent variable by β *100 (β is the coefficient of an explanatory variable). Table 17 shows the results of the average salary model. Both models were run in two steps. In the first step, the models were estimated without entry grade level controls. In the second step, entry grade controls were added.

The overall significance of both models can be explained by the R^2, which is a summary measure that indicates how well the sample regression line fits the data. Specifically, R^2 measures the proportion of the total variation in Y (dependent variable) explained by the independent variables [Ref:15]. In column 1 of Table 16, R^2 is 0.1457, which means 14.57 percent of the variation in the average salary percentage increase is explained by the variation in the explanatory variables. In the third column, R^2 is 0.3323. In Table 16, R^2's are 0.4897 in the first column and 0.6216 in the third column.

Table 16. Model of Average Percentage Salary Increase, 1986-1999

	Without Grades Control		With Grades Control	
Independent Variables	**Parameter Estimates**	**Standard Error**	**Parameter Estimates**	**Standard Error**
Intercept	44.3492*	1.1917	94.5017*	1.6442
Female	-0.0737	0.8002	-1.3871**	0.7082
Black	-0.4552	1.2072	-3.4827*	1.0701
Hispanic	-3.3933**	1.9235	-4.3944*	1.7009
Otherace	-0.6294	1.2093	-1.8292**	1.0696
Veteran	-1.8844	1.5832	2.0596	1.4033
MA86	-8.4949*	1.1092	0.7943	1.0082
PH86	-14.7923*	2.2577	6.6445*	2.0678
Supervisor	-15.5577*	2.3531	2.9111	2.1318
Technical	2.0010	1.5129	-10.9072*	1.3765
Administrative	12.5801*	0.9093	4.9774*	1.4104
Clerk	6.3503*	1.2866	-11.3805*	1.6427
Otherwc	21.6072*	4.4792	-22.2878*	4.1409
Metropolitan	1.4017	0.9613	1.1180	0.8500
Newengland	-0.7271	2.0917	-0.6870	1.7792
Midatlantic	3.1911 **	1.2980	0.3960	1.1498
Eastnorthcent	5.7885*	1.2894	4.6072*	1.1405
Westnortcent	-2.4403	1.8369	-5.0399*	1.6254
Pacific	0.6312	1.0682	-2.7680*	0.9484
Eastsouthatlan	-1.4084	1.7399	-1.5655	1.5384
Westsouthatlan	2.6834*	1.2670	-2.2590**	1.0253
Mountain	3.3147*	1.1488	0.7632*	1.5240
Priexp	-1.1439*	0.1294	0.1811	0.1192
Sqrpriexp	0.0106**	0.0043	-0.0139**	0.0003
Grade86	N.I.	N.I.	-7.1188*	0.1791
R^2	0.1457		0.3323	
Mean	41.11%		41.11%	
F Value	41.91*		117.15	
Sample size	5675		5675	

*Significant at the 1 % level ** Significant at the 5% level

N.I. = not included

Table 17. Average Salary Model, 1986 1999

Dep. Variable=ln (Av Sal)

	Without Grades Control		With Grades Control	
Independent Variables	**Parameter Estimates**	**Standard Error**	**Parameter Estimates**	**Standard Error**
Intercept	10.2746*	0.0968	10.2727*	0.0087
Female	-0.0910*	0.0063	-0.0686*	0.0055
Black	-0.0245**	0.0096	-0.0045	0.0084
Hispanic	-0.0102	0.0153	-0.0118	0.0132
Otherace	0.0504*	0.0101	0.0592*	0.0087
Veteran	0.0629*	0.0127	0.0187**	0.0110
MA86	0.0272*	0.0087	-0.0394*	0.0077
PH86	0.1852*	0.0183	-0.0486*	0.0168
Supervisor	0.2214*	0.0174	-0.0200	0.0171
Technical	-0.3975*	0.0111	-0.2505*	0.0103
Administrative	0.1808*	0.0074	-0.1170*	0.0067
Clerk	-0.5925*	0.0094	-0.2595*	0.0131
Otherwc	-0.5185*	0.0318	-0.2397*	0.0287
Metropolitan	0.0115	0.0077	0.0031	0.0066
Newengland	-0.0265*	0.0153	-0.0188	0.0132
Midatlantic	0.0332*	0.0104	-0.0025	0.0090
Eastnorthcent	0.0566*	0.0107	0.0659*	0.0093
Westnortcent	-0.1182*	0.0144	-0.0800*	0.0127
Pacific	-0.0710*	0.0084	-0.0300*	0.0073
Eastsouthatlan	0.0091*	0.0094	0.0032	0.0120
Westsouthatlan	0.0372*	0.0103	0.0179**	0.0082
Mountain	-0.0260*	0.0145	0.0148	0.0124
Priexp	0.0067*	0.0010	-0.0037*	0.0009
Sqrpriexp	-0.0001*	0.0000	0.0000	0.0000
Grade86	N.I	N.I	Yes	Yes
R^2	0.4897		0.6216	
Mean	10.12		10.12	
F Value	311.65*		331.12*	
Sample size	7495		7495	

* Significant at one percent and lower

** Significant at five percent level

N.I = not included

In the first column of Table 16, most of the variables have the expected effectson the dependent variable. However, some variables like Veteran, MA86, PH86, and Supervisor have unexpected negative effects on salary growth rate. These variables were expected to have a positive impact on earnings as suggested by past studies and human capital theory. Employees with a Master's degree received an 8.49 % lower salary growth compared to employees with a Bachelor's degree. Similarly, employees with a Doctorate had a 14.79% lower salary growth. Employees with an additional year of prior experience had a 1.14 % lower salary growth. Employees in supervisor positions at entrance also received a 15.55% lower salary increase.

In column 3 of Table 16, when entry grades were included in the model, many variables are significant; the exceptions are Veteran, MA86, Metrop86, Priexp, Newengland, Westnortcent, Southatlantic, Eastsouthatlan, and Technical. The signs of the unexpected effects of the first model turned out to be consistent with past studies, even though some of these variables are not significant in the second step. For example, employees with a Master's or Doctorate have 0.79% and a 6.64% higher salary growth within the same grades. Female employees have a lower salary growth rate than males. Black, Hispanic, and other race employees experience a 3.48% 4.39%, and 1.82%, respectively, lower growth rate than white employees. The variable Grade86 also has a negative effect on the employees' salary growth. Employees with one higher grade earn a 7.11% lower salary growth. This shows that employees with a Master's or a Doctorate are entering the DoD service at higher grades. Employees with a Master's or Doctorate receive lower salary increases when compared to employees with a Bachelor's. However, when entry grades are included in the model, salary increases of employees with a Master or Doctorate is higher than employees with a Bachelor's. This result clearly demonstrates that the salary increases of all employees who enter at higher grades are lower.

Column 1 of Table 17 shows the parameters of the explanatory variables in the average salary model when entry grades are not included in the model. All the explanatory variables are significant, except for Metropolitan and Hispanic. The average salaries of employees with a M.A or Ph.D are 2.72% and 18.52%, respectively, higher than employees with a Bachelor's. Employees in supervisor position also earn 22.14% more. Similarly, veterans and employees with an additional year of prior experience, respectively, earn 6.29% and 0.67 more. Employees in “administrative” jobs earn 18.08% more than employees in “professional” jobs, while employees in “technical” jobs, “clerical” jobs and “other white collar” jobs earn 39.75%, 59.25%, and 51.85% more, respectively. Employees in the Pacific region earn 7.10% less than employees in the South Atlantic census region, while employees in the East North Central Region census region earn 5.66% more than employees in the South Atlantic census region.

In column 3 of Table 17, when entry grades are included in the model, the effect of a M.A or Ph.D became negative. This result is very surprising because the effect of a postgraduate degree was expected to have a positive impact on salary. This may be because employees with a Master’s or Doctorate remain in the service for shorter periods; therefore, the real average salaries are lower. As explained earlier, the model used the employees who were hired in 1986 and did not eliminate those who leave early.

B. RESULTS OF PROMOTION MODELS

Two different models were specified to estimate the effect of education on the promotion probability and promotion speed. In the first model, a classical binary logit model estimates the promotion probability. In the second model, the speed of promotion is estimated using a survival technique. One survival model estimates the time to first promotion and a second estimates the time to second promotion.

The “goodness of fit” of the logit model and survival models can be examined by their -2 log L value. This value is distributed Chi-Square, and tests the null hypothesis that all coefficients are not different from zero. The -2 log L value of the logit model is 3317.71 ($p<.0001$). Similarly the -2 Log L values of the first and second promotion time survival models are 69939.215 and 67368.248, respectively ($p<.0001$ for both survival models). Another fit statistic for the logit model is the Classification Table, which provides the number of events and non-events in the model. The term “event” in the logit promotion model means that an observation that is predicted to be promoted actually gets promoted. Similarly, a “non-event” is an observation that is predicted not to be promoted and is in fact not promoted. The Classification Table shows 88.2% correctly predicted events and non-events. Therefore, both logit model and survival models are significant at all levels.

Table 18. Results of Logit Promotion Model

Independent Variables	Parameter Estimates	Standard Error	Partial Effects
Intercept	2.6889*	0.1204	
Female	-0.0621	0.1170	-0.0050
Black	0.0344	0.1813	0.0030
Hispanic	-0.1137	0.2711	-0.0105
Otherace	-0.0325	0.1527	-0.0020
Veteran	-0.0951	0.1658	-0.0087
MA86	-0.2363**	0.1346	-0.0229
PH86	-0.9041*	0.2231	-0.1134
Supervisor	-0.4295	0.2363	-0.0490
Priexp	-0.0572	0.0059	-0.0052
Ratingbest	0.0867	0.1026	0.0074
Admin	-0.0220	0.1356	-0.0020
Technical	-0.0991	0.1867	-0.0091
Clerk	0.1233	0.1812	0.0104
Otherwc	0.4974	0.7811	0.0357
Fleet	-0.9305*	0.1597	-0.1179
Intel	0.4974*	0.2724	0.0360
Training	-0.3987*	0.2156	-0.0413
Medical	-0.7017*	0.2221	-0.0816
Headqrt	-0.7135*	0.2430	-0.0830
Adminact	0.2214	0.1362	0.0179
Grade1	0.5616*	0.1463	0.0396
Grade3	-0.6403**	0.3274	-0.0728
Grade4	-14.9957	321.5	-0.9021
Sample Size			4498
-2 Log L	3317.15*		

* Significant at the 1% level

** Significant at the 5% level

In the logit model, 3,954 employees are promoted out of 4,498 total employees (87.9%). Employees who left before 1992 are not included in the model. The logit model indicates that not much variation is observed on the effects of explanatory variables on the dependent variable since nearly all employees are promoted. However, the results show significant effects of graduate education. Employees with a Master's or Doctorate are 2.29% and 11.34%, respectively, less likely to be promoted than employees with a Bachelor's in Table 18. Employees in grade group 1 (Grades 1 to 5) are 7.28% more likely to be promoted than employees in grade group 2 (Grades 6 to 9). As expected, employees in grade group 3 (grades 10 to 13) and grade group 4 (grades 14 to 15) are less likely to be promoted. The coefficient of the group grade 4 is not significant because group grade 4 is already the top grade in the service and there is no promotion from this grade. Employees who receive the best average rating (1=outstanding or 2=exceeds fully successful) have the expected positive effect on promotion, but the coefficient is not significant. This suggests that performance ratings are not important in determining promotion. This is contrary to the expectation that the best ratings would affect the promotion probability. Another surprising result is that none of the sex and ethnicity variables are significant. This also contradicts the studies of Usan and Utoglu [Ref:7] and Asch [Ref:8]. Employees in functional areas of Training, Medical, and Headquarters are 4.18%, 8.16% and 8.30%, respectively, less likely to be promoted than employees in the Material functional area.

The survival results in Table 19 are consistent with the results of the logit model. In the time to first promotion model, employees with a Master's or Doctorate are 18.10% (1-0.819, the hazard ratio) and 0.434% (1-0.566) less likely (slower) to be promoted, respectively. In the time to second promotion model, employees with a Master or Doctorate degree are 13.2 % (1- 0.868) and 34.9% (1-0.651) less likely to be promoted, respectively. In both survival models, one additional year of prior experience decreases the promotion probability by 1.6% and 0.4%, respectively. In both survival models, employees in functional areas of Training and Medical are less likely to be promoted, while employees in functional areas of Intelligence and Administrative activities are more likely to be promoted. The surprising results are that none of the sex and ethnicity variables are significant. Another unexpected result is that employees with good ratings (outstanding or exceeds fully successful) are less likely to be promoted in both models. However, cumrat1 variable in time to second promotion has the expected positive effect on promotion.

Table 19. Results of Time to First and Second Promotion

	Time to First Promotion			Time to Second Promotion		
Independent Variables	**Parameter Estimates**	**Standard Error**	**Risk Ratio**	**Parameter Estimates**	**Standard Error**	**Risk Ratio**
Female	0.0350	0.0361	1.036	0.0677**	0.0036	1.070
Black	0.0267	0.0527	1.027	-0.0198	0.0534	0.980
Hispanic	-0.0189	0.0844	0.981	-0.0665	0.0860	0.936
Otherace	0.0436	0.0493	1.045	0.0318	0.0495	1.032
Veteran	-0.0423	0.0694	0.959	-0.0355	0.0682	-0.965
MA86	-0.1994*	0.0498	0.819	-0.1324*	0.0497	0.876
PH86	-0.5688*	0.0977	0.566	-0.4286*	0.1005	0.655
Supervisor	-0.3281*	0.1058	0.720	0.0256	0.1015	1.026
Priexp	-0.0165*	0.0023	0.984	0.0439	0.0024	0.996
Admin	0.1071*	0.0409	1.113	-0.0386	0.0409	0.962
Technical	-0.1582*	0.0678	1.172	0.0428	0.0684	1.043
Clerk	0.4961*	0.0636	1.642	0.3061*	0.0598	1.358
Otherwc	0.5959*	0.2162	1.815	0.4800**	0.2157	1.616
Fleet	-0.2178*	0.0652	0.804	-0.2698*	0.0673	0.764
Intel	0.0743*	0.0630	1.077	0.1162**	0.0647	1.123
Trainning	-0.1685*	0.0889	0.845	-0.2200**	0.0929	0.802
Medical	-0.1142*	0.0983	0.892	-0.0258	0.1009	0.974
Headqrt	-0.0547*	0.0980	0.947	0.0742	0.0951	1.077
Adminact	0.1208*	0.0378	1.129	0.1062	0.0372	1.112
Cumrat1	-0.0543	0.0544	0.947	0.0502**	0.0199	0.951
Cumrat2	-0.0223	0.0442	0.978	-0.0181	0.0178	0.981
Time1				0.3249*	0.0091	1.385
Grade	0.1187*	0.0064	1.126	0.1225*	0.0042	1.130
% Censored	3.52			%Censored	5.94	
-2 Log L	69939.215			-2 Log L	67368.248	

* Significant at the1% level

** Significant at the 5% level

C. RESULTS OF RETENTION MODELS

Two retention models were created to analyze the effect of graduate education on the retention of DoD civilian employees with the expectation that the employees would act as utility maximizers. Theory supports the view that employees would prefer to stay in the DoD civilian service if their gain within the service exceeds their gain in the private sector.

The first retention model uses a binary logit technique for employees hired in 1986. In this model, employees are followed until 1992 to see whether they are still in the service or not. If they are still in the service, the dependent variable is coded 1; otherwise it is coded 0.

The second retention model is a survival model based on a Cox regression. In this model, the time to separation is estimated. The data sample contains employees hired in 1986. These employees are tracked until 1999, the end of the data. During this 14 year-period, snapshots of employees were taken every two years, except for the last year, 1999. Since Cox regression also considers censored elements, employees who are not separated at the end of the data are used to indicate censored data, while the dependent variable of the time to separation in years is determined by the employees' service years in DoD before separation.

The "goodness of fit" of the models can be examined again by the -2 Log L values. The logit model has the -2 Log L value of 7418.591 with $p<.0001$. The survival model for retention has the -2 Log L value of 58654.031 with $p<.0001$. Also the Classification Table of the logit model predicts 77.60 percent of the "events" and "non-events" correctly. Based on these results, the models have explanatory power.

In the logit model results in Table 20, 15 variables out of 20 are significant except for Hispanic, Veteran, Intel, Admin, and Supervisor variables. The variables have the expected results. For example, employees with a Master's or Doctorate are 5.59% and 6.39%, respectively, less likely to stay in the DoD service. Female employees are also 5.36% less likely to stay in the service than male employees. On the other hand, Black and Otherrace employees are more likely to stay in the service than whites. As expected older employees are more likely to stay. However, employees in all functional areas are less likely to stay in the service than employees in material functional area. Similarly, employees in all occupations except for administrative occupation are less likely to stay in the service than employees in professional occupations. As expected in other studies, employees who get higher performance ratings are more likely to stay in the service.

Table 20. Results of Binary Logit Retention

Independent Variables	Parameter Estimates	Standard Error	Partial Effects
Intercept	-4.1000*	0.2495	
Female	-0.3454*	0.0703	-0.0536
Black	0.3344*	0.1043	0.0430
Hispanic	-0.1081*	0.1563	-0.0161
Otherace	0.5871*	0.1118	0.0693
Veteran	0.0464	0.1406	0.0065
Age86	0.0172*	0.0044	0.0024
MA86	-0.3478*	0.0958	-0.0559
PH86	-0.3923**	0.2056	-0.0638
Supervisor	-0.2890	0.1954	-0.0456
Admin	0.0736	0.0832	0.0103
Technical	-0.2104**	0.1222	-0.0324
Clerk	-0.3483*	01090	-0.0560
Otherwc	-1.2064*	0.3394	-0.2394
Fleet	-0.9859*	0.1266	-0.1871
Intel	-0.1784	0.1381	-0.0272
Trainning	-1.0849*	0.1471	-0.2103
Medical	-1.8033*	0.1364	-0.3874
Headqrt	-0.8892*	0.1789	-0.1606
Adminact	-1.0849*	0.0076	-0.0384
Ratingtop	1.3829	0.0589	0.1240
-2 Log L	7418.591*		
Chi-Sq	1084.596*		

*Significant at the 1% level

**Significant at the 5% level

Ratingtop variable is reversed for statistical purposes.

In the Cox regression model of retention in Table 21, similar results are found. For example, employees with a Master's or Doctorate are 15.7% and 25.3%, respectively, more likely to leave the federal service than employees with a Bachelor degree. Again employees who receive the best performance ratings are less likely to leave the service.

Table 21. Cox Regression of Time to Separation

Independent Variables	Parameter Estimates	Standard Error	Risk Ratio
Female	0.34811*	0.0388	1.416
Black	-0.2958*	0.0569	0.744
Hispanic	0.0799	0.0844	1.083
Otherace	-0.3985*	0.0628	0.671
Veteran	-0.1074*	0.0726	0.898
Age86	-0.0071*	0.0023	0.993
MA86	0.1454*	0.0521	1.157
PH86	0.2258*	0.1155	1.253
Supervisor	0.2932*	0.0910	1.341
Admin	-0.0159	0.0470	0.984
Technical	0.2457*	0.0601	1.282
Clerk	0.1543*	0.0564	1.167
Otherwc	0.4788*	0.1876	1.614
Fleet	0.6623*	0.0570	1.939
Intel	0.5755*	0.0680	1.778
Trainning	0.7338*	0.0825	2.083
Medical	0.9757*	0.0717	2.653
Headqrt	0.4764*	0.1073	1.610
Adminact	0.0749	0.0461	1.075
Cumrat1	-2.6935*	0.0845	0.068
Cumrat2	-1.3891*	0.0729	0.249
% Censored	49.19		
-2 Log L	58654.031*		
Chi-Sq	1892.240*		

* Significant at the 1% level

** Significant at the 5% level

D. THE RESULTS OF PERFORMANCE RATING MODELS

As explained in Chapter IV, performance ratings are not perfect in measuring employees' performance, but they provide some information about the overall performance of the employees. In estimating the relative performance of employees, two different models are estimated. The first model analyzes the percentage of "Outstanding" ratings received by employees hired in 1986 over their service period. In other words, this ratio is calculated for all of the times that the employees are evaluated for their performance. There are 7,811 observations for this model. The dependent variable is the ratio of cumulative rating 1 (Outstanding) over total ratings and the model is estimated by OLS. The second model estimates the probability of becoming a supervisor. This model assumes that the better performing employees will be given a supervisor position and will be promoted to higher grades. Therefore, the binary logit model is used to estimate the probability of being selected for a supervisor position.

The "goodness of fit" of the first regression model is examined by the R^2, the coefficient of determination, which is .0410. Also the overall significance of the regression model can be measured by the F value of the model. As long as the F-value is significant, then the null hypothesis that there is no power of the model is rejected. In this model the F value of 18.52 is significant at the P>.0001 level. The "goodness of fit" of the logit model for being placed in a supervisor job can be measured by the – 2 Log L value which is 2165.949 with p=.0001. This shows us that the model has some explanatory power. The classification table of the model also correctly predicts 88.3% of the "events" and "non-events" of the model at 0.6 "cut-off" point.

In the first model in Table22 employees with a Master's or Doctorate are 2% and 9.32%, respectively, more likely to obtain the highest performance ratings than employees with a Bachelor's degree. Also Black, Hispanic, and other race employees in the federal service are less likely to obtain the top ratings compared to whites.

In the logit model for the probability of being a supervisor, results are consistent with the first model for example, employees with a Master's or Doctorate are 8.8% and 16.8%, respectively, more likely to be a supervisor when the top rating variable is excluded from the model. However, when the top rating variable (Cumrat) is included in the model the effect of a Master's or Doctorate dropped to 4.96% and 8.84%, respectively.

Table 22. Results of OLS Performance Rating Model

Independent Variables	Parameter Estimates	Standard Error
Intercept	0.1216*	0.0047
Female	0.0089	0.0055
Black	-0.0224*	0.0082
Hispanic	-0.0258**	0.0128
Otherace	-0.0216**	0.0085
Veteran	0.0572*	0.0100
MA86	0.0201*	0.0073
PH86	0.0932*	0,0156
Supervisor	0.0645*	0.0141
Admin	0.0235*	0.0065
Technical	-0.0240*	0.0091
Clerk	0.0049	0.0811
Otherwc	-0.0298	0.0283
Fleet	0.0052	0.0083
Intel	0.0243**	0.0109
Trainning	0.1123*	0.0130
Medical	0.0492*	0.0113
Headqrt	0.0106*	0.0144
Adminact	-0.0194*	0.0619
Sample Size	7811	
R^2	.041	
F Value	18.52	

* Significant at 1 percent level

** Significant at 5 percent level

Table 23. Logit Model of Achieving Supervisor Status

	Rating not Included			Rating Included		
Independent Variables	**Parameter Estimates**	**Standard Error**	**Partial Effects**	**Parameter Estimates**	**Standard Error**	**Partial Effects**
Intercept	-2.1244*	0.1054		-2.7918*	0.1502	
Female	-0.0367	0.1452	-0.0034	-0.0804	0.1473	-0.0042
Black	-0.6430*	0.2472	-0.0476	-0.5519*	0.2502	-0.0236
Hispanic	0.0429	0.3146	0.0042	0.1194	0.3210	0.0069
Otherace	-0.5233*	0.2159	-0.0406	-0.3689**	0.2184	-0.0170
Veteran	0.8922*	0.1874	0.1191	0.8946*	0.1910	0.0727
MA86	0.7050*	0.1523	0.0880	0.6734*	0.1549	0.0496
PH86	1.1545*	0.2495	0.1681	1.0269*	0.2524	0.0884
Admin	0.0503	0.1490	0.0049	0.0427	0.1511	0.0024
Technical	-0.2404	0.2929	-0.0192	-0.2741	0.2463	-0.0132
Clerk	-1.3058*	0.3093	-0.0754	-1.3136*	0.3108	-0.0414
Otherwc	-0.2191	0.7911	-0.0192	-0.3383	0.8057	-0.0158
Fleet	1.1760*	0.1963	0.1725	1.0358*	0.2001	0.0895
Intel	0.2140*	0.3242	0.0222	0.0708	0.3279	0.0040
Trainning	0.3673	0.2813	0.0404	0.2515	0.2853	0.0153
Medical	0.3347	0.3314	0.0364	0.1555	0.3349	0.0091
Headqrt	0.1220	0.3254	0.0122	0.0730	0.3280	-0.0037
Adminact	-0.4036*	0.1562	-0.0328	-0.3066**	0.1580	-0.0145
Cumrat				1.0171*	0.1428	0.0872
-2 Log L	2165.949*			-2 Log L 2165.949*		
Chi-Sq	174.374*			Chi-Sq 231.273*		

*Significant at the 1% level

** Significant at the 5% level

IV. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

This thesis analyzed the relationship between graduate education and the job performance of DoD civilian employees. In the thesis, four proxy performance measures (salary, promotion, retention, and performance ratings) were used to gauge the effect of advanced education on employee productivity. The results in these models are generally consistent with previous studies.

First of all, employees with a Master's or Doctorate at entry have lower real salary growth rates increases than employees with only a Bachelor's degree. However, when the GS entry grades are included in the model, the effect of graduate education on real salary growth rate became positive indicating higher growth rates for employees with graduate degrees. In the second model of annual average salaries, the results are as expected and show that employees with a Master's or Doctorate earn more on average than employees with a Bachelor's. However, when GS entry grades are included in the model the effect of graduate education became negative. This result was surprising and may be explained by the shorter tenure of employees with a Master's or Doctorate in the DoD civilian service. All of these results are somewhat consistent with the Usan and Utoglu study [Ref:7] and Asch [Ref:8].

In analyzing promotion outcomes, two different measures are used. The first one measures the promotion probability, and the second one measures promotion speed. In the promotion probability model, employees with a Master's or Doctorate are less likely to be promoted. In the promotion speed model, the results indicate employees with a Master's or a Doctorate are slower to attain a promotion than employees with a Bachelor's degree. Usan and Utoglu found similar results indicating that the effect of graduate education on the promotion probability was lower. Asch also suggested that even though employees with a Bachelor's degree promoted faster, it does not always mean that advanced education slows the pace of promotions. Surprisingly, the results here show that having top performance ratings does not affect the speed of first promotion. However, receiving top performance ratings does have a positive effect on the second promotion speed.

The results of both binary logit and Cox regression analyses of retention are consistent with previous studies of DoD civilian employees. Previous analyses found that the effect of personnel quality and education on retention is ambiguous and cannot be predicted a priori since higher qualified personnel have better opportunities both inside and outside the federal service. In the binary logit model, employees with a Master's or Doctorate are 5.38% and 6.69%, respectively, more likely to leave the service. Similarly, in Cox regressions of time to separation, employees with a Master's or Doctorate leave federal service 15.7% and 25.3%, respectively, sooner than employees with a Bachelor's degree. The Cox regression model gives similar results. As in previous studies, employees with good performing ratings are more likely to stay in the service since superior rating indicates a good match between employees and the job has been established.

The results of a binary logit model for being a supervisor and a regression model for the percent of top ratings both indicate that employees with higher education are more likely to be a supervisor and to receive higher performance ratings in the federal service.

In summary, employees with a Master's or Doctorate gain more and receive higher salary increases in the service. However, employees with a Master's or Doctorate are promoted slower since they are placed at the higher GS grades at entry in the service, which hinders subsequent promotion. Even though employees with a Master's or a Doctorate receive the best performance ratings and are more likely to be selected as supervisors, they leave the service earlier than other employees. This result supports the concept that the incentives of the outside market exceed the incentives inside the federal service for more highly educated employees.

B. RECOMMENDATIONS

Initially, a new data set should be gathered for further research to see more recent changes in the DoD civilian service. Some miscoding or some flaws, especially in the education levels, the performance ratings, and the annual salaries of personnel data file exist in the DMDC file. The new data set should provide information on the source of education, namely, whether the employees paid for higher education or whether DoD shared the cost of education. By basing the effect of graduate education on the source of education the results can be more informative for personnel policy changes.

Secondly, any bonuses, which the employees received in a year, should be added to the personnel data so that the effect these bonuses have on retention can be measured and the relationship between the earnings and retention can be evaluated for the purpose of keeping higher quality employees in the service. Also each occupation must be compared to the civilian counterparts in terms of earnings or earnings increase in each year so that personnel managers can take precautions to keep higher quality personnel from leaving.

Finally, research should be conducted on whether the retention of higher-level personnel is sufficient to meet current and future personnel requirements. In this analysis higher educated personnel are more likely to leave the service early. How does this behavior affect the requirements of each occupation? Future research should also conduct a cost-benefit analysis of the higher educated personnel to fill the gaps or requirements from outside the service or within the service.

LIST OF REFERENCES

1. Wise, David A., "Academic Achievement and Job Performance," American *Economic Review*, June 1975.

2. Wise, David A., "Personal Attributes, Job Performance, and Probability of Promotion," *Econometrica*, Vol.43, No.5-6 (September-November), 1975.

3. Medoff and Abraham, "Experience, Performance and Earnings," *Quarterly Journal of Economics*, December 1980.

4. Medoff and Abraham, "Are Those Paid More Really More Productive? The Case of Experience," *The Journal of Human Resources*, 16(Winter), 1981.

5. Dunson, Bruce, "Pay, Experience, and Productivity: The Government-Sector Case," *Journal of Human Resources*, 20 (Winter), 1985.

6. Bowman and Mehay, "Graduate Education and Employee Performance: Evidence from Military Personnel," *Economics of Education Review*, 18 October 1999

7. Usan and Utoglu, "The Effect of Graduate Education on the Job Performance of Civilian Department of Defense Employees" Master's Thesis, Naval Postgraduate School, March 1999.

8. Beth J. Asch, "The Pay, Promotion, and Retention of High- Quality Civil Service Workers in the Department of Defense," Santa Monica, CA: RAND, MR-1193-OSD, 2001.

9. Gujarati, Damodar N., *Basic Econometrics*, 3rd edition McGraw-Hill, Inc., 1995, pp. 556-562.

10. *1999 Federal Personnel Guide*, Key Communications Group, Inc.

11. *Federal Employees Almanac*, Federal Employees News Digest, Inc., 4th Edition, 1999.

12. Asch and Warner, "*Separation and Retirement Incentives in the Civil Service: A Comparison of the Federal Employees Retirement System*, Santa Monica, CA: RAND, MR-986-OSD, 1999.

13. Ippolita, Richard A., "Why Federal Workers Don't Quit" *Journal of Human Resources*, 22 (Spring), 1987.

14. Muchinsky,Paul M., *Psychology Applied To Work*, 5th Edition, Brooks/Cole Publishing Company, 1996, 222-224.

15. Studenmund, A. H., *Using Econometrics, a Practical Guide,* 4th Edition, Addison Wesley Longman.

APPENDIX DEFENSE CIVILIAN PERSONNEL DATA FILE LA YOUT (8609 THROUGH 9902)

(DA T A ELEMENTS USED IN THE THESIS)

(Source: Defense Manpower Data Center

FIELD	FIELD NAME	TYPE	LENGTH	START	END	FIELD	FIELD NAME	TYPE	LENGTH	START	END
1	SERVICE COMPUTATION DATE (YYMM)	N	4	1	4	52	EDUCATION	N	2	128	129
2	CITIZEN	N	1	5	5	53	YEAR DEGREE ATTAINED	N	2	130	131
3	DATE OF BIRTH (YYMM)	N	4	6	9	54	RACE	N	1	132	132
4	NATURE OF ACTION DATE (YYMM)	N	4	10	13	55	TOTAL FEDERAL SERVICE MONTHS	N	3	133	135
5	SALARY	C	5	14	18	56	TOTAL FEDERAL SERVICE YEARS	N	2	136	137
6	OCCUPATION	C	5	19	23	57	AGE	N	2	138	139
7	STATE/COUNTRY	N	3	24	26	58	YEARLY COMPENSATION	C	5	140	144
8	CITY	N	4	27	30	59	METROPOLITAN STATISTICAL AREA (MSA)	N	4	145	148
9	COUNTY	N	3	31	33	60	WAGE AREA	N	3	149	151
10	VETERANS PREFERENCE	N	1	34	34	61	DOD OCCUPATION GROUP	N	4	152	155
11	TENURE	N	1	35	35	62	SEASONAL FLAG	N	1	156	156
12	SEX	N	1	36	36	63	CENSUS REGION	N	2	157	158
13	AGENCY	N	1	37	37	64	CENSUS DISTRICT	N	2	159	160
14	BUREAU	N	2	38	39	65	CREDITABLE MILITARY SERVICE (YYMM)	N	4	161	164
15	PAYPLAN	N	2	40	41	66	DATE OF LAST PROMOTION (YYMM)	N	4	165	168
16	GRADE	N	2	42	43	67	DATE ENTERED CURRENT GRADE (YYMM)	N	4	169	172
17	STEP	N	2	44	45	68	RATING	N	1	173	173
18	EDUCATION	N	2	46	47	69	SUPERVISORY	N	1	174	174
19	YEAR DEGREE ATTAINED (YY)	N	2	48	49	70	PATCO	N	1	175	175
20	RACE	N	1	50	50	71	FUNCTIONAL AREA	N	1	176	176
21	TOTAL FEDERAL SERVICE MONTHS	N	3	51	53	72	SERVICE COMPUTATION DATE (YYMM)	N	4	177	180
22	TOTAL FEDERAL SERVICE YEARS	N	2	54	55	73	CITIZEN	N	1	181	181
23	AGE	N	2	56	57	74	DATE OF BIRTH (YYMM)	N	4	182	185
24	YEARLY COMPENSATION	C	5	58	62	75	NATURE OF ACTION CODE (YYMM)	N	4	186	189
25	METROPOLITAN STATISTICAL AREA	N	4	63	66	76	OCCUPATION	C	5	190	194
26	WAGE AREA	N	3	67	69	77	STATE/COUNTRY	N	3	195	197
27	DOD OCCUPATION GROUP	N	4	70	73	78	CITY	N	4	198	201
28	SEASONAL FLAG	N	1	74	74	79	COUNTY	N	3	202	204
29	CENSUS REGION	N	2	75	76	80	VETERANS PREFERENCE	N	1	205	205
30	CENSUS DISTRICT	N	2	77	78	81	TENURE	N	1	206	206
31	RATING	N	1	79	79	82	SEX	N	1	207	207
32	SUPERVISORY	N	1	80	80	83	AGENCY	N	1	208	208
33	PATCO	N	1	81	81	84	BUREAU	N	2	209	210
34	FUNCTIONAL AREA	N	1	82	82	85	PAYPLAN	N	2	211	212
35	SERVICE COMPUTATION DATE (YYMM)	N	4	83	86	86	GRADE	N	2	213	214
36	CITIZEN	N	1	87	87	87	STEP	N	2	215	216
37	DATE OF BIRTH (YYMM)	N	4	88	91	88	EDUCATION	N	2	217	218
38	NATURE OF ACTION DATE (YYMM)	N	4	92	95	89	YEAR DEGREE ATTAINED	N	2	219	220
39	SALARY	C	5	96	100	90	RACE	N	1	221	221
40	OCCUPATION	C	5	101	105	91	TOTAL FEDERAL SERVICE MONTHS	N	3	222	224
41	STATE/COUNTRY	N	3	106	108	92	TOTAL FEDERAL SERVICE YEARS	N	2	225	226
42	CITY	N	4	109	112	93	AGE	N	2	227	228
43	COUNTY	N	3	113	115	94	YEARLY COMPENSATION	C	6	229	234
44	VETERANS PREFERENCE	N	1	116	116	95	METROPOLITAN STATISTICAL AREA (MSA)	N	4	235	238
45	TENURE	N	1	117	117	96	WAGE AREA	N	3	239	241
46	SEX	N	1	118	118	97	DOD OCCUPATION GROUP	N	4	242	245
47	AGENCY	N	1	119	119	98	SEASONAL FLAG	N	1	246	246
48	BUREAU	N	2	120	121	99	CENSUS REGION	N	2	247	248
49	PAYPLAN	N	2	122	123	100	CENSUS DISTRICT	N	1	249	249
50	GRADE	N	2	124	125	101	CREDITABLE MILITARY SERVICE (YYMM)	N	4	250	253
51	STEP	N	2	126	127	102	DATE OF LAST PROMOTION (YYMM)	N	4	254	257

FIELD	FIELD NAME	TYPE	LENGTH	START	END
103	DATE OF CURRENT GRADE (YYMM)	N	4	258	261
104	SALARY	C	6	262	267
105	RATING	N	1	268	268
106	SUPERVISORY	N	1	269	269
107	PATCO	N	1	270	270
108	FUNCTIONAL AREA	N	1	271	271
109	SERVICE COMPUTATION DATE (YYMM)	N	4	272	275
110	CITIZEN	N	1	276	276
111	DATE OF BIRTH (YYMM)	N	4	277	280
112	NATURE OF ACTION DATE (YYMM)	N	4	281	284
113	OCCUPATION	C	5	285	289
114	STATE/COUNTRY	N	3	290	292
115	CITY	N	4	293	296
116	COUNTY	N	3	297	299
117	VETERANS PREFERENCE	N	1	300	300
118	TENURE	N	1	301	301
119	SEX	N	1	302	302
120	AGENCY	N	1	303	303
121	BUREAU	N	2	304	305
122	PAYPLAN	N	2	306	307
123	GRADE	N	2	308	309
124	STEP	N	2	310	311
125	EDUCATION	N	2	312	313
126	YEAR DEGREE ATTAINED	N	2	314	315
127	RACE	N	1	316	316
128	TOTAL FEDERAL SERVICE MONTHS	N	3	317	319
129	TOTAL FEDERAL SERVICE YEARS	N	2	320	321
130	AGE	N	2	322	323
131	YEARLY COMPENSATION	C	6	324	329
132	METROPOLITAN STATISTICAL AREA	N	4	330	333
133	WAGEAREA	N	3	334	336
134	DOD OCCUPATION GROUP	N	4	337	340
135	SEASONAL FLAG	N	1	341	341
136	CENSUS REGION	N	2	342	343
137	CENSUS DISTRICT	N	1	344	344
138	CREDITABLE MILITARY SERVICE (YYMM)	N	4	345	348
139	DATE OF LAST PROMOTION (YYMM)	N	4	349	352
140	DATE OF CURRENT GRADE (YYMM)	N	4	353	356
141	SALARY	C	6	357	362
142	RATING	N	1	363	363
143	SUPERVISORY	N	1	364	364
144	PATCO	N	1	365	365
145	FUNCTIONAL AREA	N	1	366	366
146	SERVICE COMPUTATION DATE (YYMM)	N	4	367	370
147	CITIZEN	N	1	371	371
148	DATE OF BIRTH (YYMM)	N	4	372	375
149	NATURE OF ACTION DATE (YYMM)	N	4	376	379
291	DATE OF LAST PROMOTION (YYMM)	N	4	741	744
292	DATE ENTERED GRADE (YYMM)	N	4	745	748
293	PAYRATE	C	6	749	754
294	BASIC PAY	C	6	755	760
295	RATING	C	1	761	761
296	SUPERVISORY	N	1	762	762
297	PATCO	C	1	763	763
298	FUNCTIONAL AREA	N	1	764	764
299	CONSOLIDATED MSA	N	2	765	766
300	INSTRUCTIONAL PROGRAM	C	6	767	772
301	NATURE OF ACTION DATE (YYMM)	N	4	773	776
302	COUNTRY	C	2	777	778
150	OCCUPATION	C	5	380	384
151	STATE/COUNTRY	N	3	385	387
152	CITY	N	4	388	391
153	COUNTY	N	3	392	394
154	VETERANS PREFERENCE	N	1	395	395
155	TENURE	N	1	396	396
156	SEX	N	1	397	397
157	AGENCY	N	1	398	398
158	BUREAU	N	2	399	400
159	PAYPLAN	N	2	401	402
160	GRADE	N	2	403	404
161	STEP	N	2	405	406
162	EDUCATION	N	2	407	408
163	YEAR DEGREE ATTAINED	N	2	409	410
164	RACE	N	1	411	411
165	TOTAL FEDERAL SERVICE MONTHS	N	3	412	414
166	TOTAL FEDERAL SERVICE YEARS	N	2	415	416
167	AGE	N	2	417	418
168	YEARLY COMPENSATION	C	6	419	424
169	METROPOLITAN STATISTICAL AREA (MSA)	N	4	425	428
170	WAGEAREA	N	3	429	431
171	DOD OCCUPATION GROUP	N	4	432	435
172	SEASONAL FLAG	N	1	436	436
173	CENSUS REGION	N	2	437	438
174	CENSUS DISTRICT	N	1	439	439
175	CREDITABLE MILITARY SERVICE (YYMM)	N	4	440	443
176	DATE OF LAST PROMOTION (YYMM)	N	4	444	447
177	DATE ENTERED GRADE (YYMM)	N	4	448	451
178	SALARY	C	6	452	457
179	RATING	N	1	458	458
180	SUPERVISORY	N	1	459	459
181	PATCO	N	1	460	460
182	FUNCTIONAL AREA	N	1	461	461
183	CONSOLIDATED MSA	N	2	462	463
184	INSTRUCTIONAL PROGRAM	N	6	464	469
185	SERVICE COMPUTATION DATE (YYMM)	N	4	470	473
186	CITIZEN	N	1	474	474
187	DATE OF BIRTH (YYMM)	N	4	475	478
188	NATURE OF ACTION DATE (YYMM)	N	4	479	482
189	OCCUPATION	C	5	483	487
190	STATE/COUNTRY	N	3	488	490
191	CITY	N	4	491	494
192	COUNTY	N	3	495	497
193	VETERANS PREFERENCE	N	1	498	498
194	TENURE	N	1	499	499
195	SEX	N	1	500	500
196	AGENCY	N	1	501	501
303	STATE	C	2	779	780
304	CITY	C	4	781	784
305	COUNTY	C	3	785	787
306	RATING PATTERN	C	1	788	788
307	RATING PERIOD	C	6	789	794
308	FLAG88	N	1	795	795
309	FLAG90	N	1	796	796
310	FLAG92	N	1	797	797
311	FLAG94	N	1	798	798
312	FLAG96	N	1	799	799
313	FLAG98	N	1	800	800
314	FLAG99	N	1	801	801

FIELD	FIELD NAME	TYPE	LENGTH	START	END
197	BUREAU	N	2	502	503
198	PAYPLAN	N	2	504	505
199	GRADE	N	2	506	507
200	STEP	N	2	508	509
201	EDUCATION	N	2	510	511
202	YEAR DEGREE ATTAINED	N	2	512	513
203	RACE	N	1	514	514
204	TOTAL FEDERAL SERVICE MONTHS	N	3	515	517
205	TOTAL FEDERAL SERVICE YEARS	N	2	518	519
206	AGE	N	2	520	521
207	YEARLY COMPENSATION	C	6	522	527
208	METROPOLITAN STATISTICAL AREA	N	4	528	531
209	WAGE AREA	N	3	532	534
210	DOD OCCUPATION GROUP	N	4	535	538
211	SEASONAL FLAG	N	1	539	539
212	CENSUS REGION	N	2	540	541
213	CENSUS DISTRICT	N	1	542	542
214	CREDITABLE MILITARY SERVICE (YYMM)	N	4	543	546
215	DATE OF LAST PROMOTION (YYMM)	N	4	547	550
216	DATE ENTERED GRADE (YYMM)	N	4	551	554
217	SALARY	C	6	555	560
218	RATING	N	1	561	561
219	SUPERVISORY	N	1	562	562
220	PATCO	N	1	563	563
221	FUNCTIONAL AREA	N	1	564	564
222	CONSOLIDATED MSA	N	2	565	566
223	INSTRUCTIONAL PROGRAM	C	6	567	572
224	SERVICE COMPUTATION DATE (YYMM)	N	4	573	576
225	CITIZEN	N	1	577	577
226	DATE OF BIRTH (YYMM)	N	4	578	581
227	OCCUPATION	C	5	582	586
228	VETERANS PREFERENCE	N	1	587	587
229	TENURE	N	1	588	588
230	SEX	N	1	589	589
231	AGENCY	N	1	590	590
232	BUREAU	N	2	591	592
233	PAYPLAN	N	2	593	594
234	GRADE	N	2	595	596
235	STEP	N	2	597	598
236	EDUCATION	N	2	599	600
237	YEAR DEGREE ATTAINED	N	2	601	602
238	RACE	N	1	603	603
239	TOTAL FEDERAL SERVICE MONTHS	N	3	604	606
240	TOTAL FEDERAL SERVICE YEARS	N	2	607	608
241	AGE	N	2	609	610
242	METROPOLITAN STATISTICAL AREA	N	4	611	614
243	WAGE AREA	N	3	615	617
244	DOD OCCUPATION GROUP	N	4	618	621
245	SEASONAL FLAG	N	1	622	622
246	CENSUS REGION	N	2	623	624
247	CENSUS DISTRICT	N	1	625	625
248	CREDITABLE MILITARY SERVICE (YYMM)	N	4	626	629
249	DATE OF LAST PROMOTION (YYMM)	N	4	630	633
250	DATE ENTERED CURRENT GRADE (YYMM)	N	4	634	637
251	PAYRATE	C	6	638	643
252	BASIC PAY	C	6	644	649
253	RATING	C	1	650	650
254	SUPERVISORY	N	1	651	651
255	PATCO	C	1	652	652
256	FUNCTIONAL AREA	N	1	653	653
257	CONSOLIDATED MSA	N	2	654	655
258	INSTRUCTIONAL PROGRAM	C	6	656	661
259	NATURE OF ACTION DATE (YYMM)	N	4	662	665
260	COUNTRY	N	2	666	667
261	STATE	C	2	668	669
262	CITY	C	4	670	673
263	COUNTY	C	3	674	676
264	RATING PATTERN	C	1	677	677
265	RATING PERIOD (YYYYMM)	C	6	678	683
266	SERVICE COMPUTATION DATE (YYMM)	N	4	684	687
267	CITIZEN	N	1	688	688
268	DATE OF BIRTH (YYMM)	N	4	689	692
269	OCCUPATION	C	5	693	697
270	VETERANS PREFERENCE	N	1	698	698
271	TENURE	N	1	699	699
272	SEX	N	1	700	700
273	AGENCY	N	1	701	701
274	BUREAU	N	2	702	703
275	PAYPLAN	N	2	704	705
276	GRADE	N	2	706	707
277	STEP	N	2	708	709
278	EDUCATION	N	2	710	711
279	YEAR DEGREE ATTAINED	N	2	712	713
280	RACE	N	1	714	714
281	TOTAL FEDERAL SERVICE MONTHS	N	3	715	717
282	TOTAL FEDERAL SERVICE YEARS	N	2	718	719
283	AGE	N	2	720	721
284	METROPOLITAN STATISTICAL AREA (MSA)	N	4	722	725
285	WAGE AREA	N	3	726	728
286	DOD OCCUPATION GROUP	N	4	729	732
287	SEASONAL FLAG	N	1	733	733
288	CENSUS REGION	N	2	734	735
289	CENSUS DISTRICT	N	1	736	736
290	CREDITABLE MILITARY SERVICE (YYMM)	N	4	737	740

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